United States Department of Agriculture

Economic Research Service

Agricultural Economic Report Number 567

The U.S. Cotton Industry

Irving R. Starbird
Edward H. Glade, Jr.
W. C. McArthur
Fred T. Cooke, Jr.
Terry Townsend

THE U.S. COTTON INDUSTRY. By Irving R. Starbird, Edward H. Glade, Jr., W.C. McArthur, Fred T. Cooke, Jr., and Terry Townsend. National Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 567.

ABSTRACT

U.S. farmers produced about 17 percent of the world's cotton in 1985, down from about 31 percent in 1960. During the same time, cotton's share of the world textile fiber market dropped from nearly 70 percent to about 50 percent. The United States, China, and the Soviet Union produce about 60 percent of the world's cotton. Although total harvested acreage in the United States dropped by about 33 percent between 1960 and 1985, production dropped by less than 6 percent because of increased yields. Cotton and other natural fibers have faced stiff competition from manmade fibers during the last 25 years. However, demand for cotton and cotton blends, especially, has recently increased. U.S. cotton producers have frequently been plagued by excess production capacity, high stocks, and low product prices. Growth in the U.S. cotton industry will continue to depend heavily on exports, as domestic mill consumption may be constrained by textile imports and competition from manmade fibers. This report describes all components of the U.S. cotton industry, from producers to consumers, and provides a single source of economic and statistical information on cotton.

Keywords: Cotton, cotton industry, production, marketing, demand and pricing, world trade, Government programs

ACKNOWLEDGMENTS

The authors appreciate the reviews, suggestions, and contributions of Duane Hacklander, Sam Evans, Robert McElroy, John Hostetler (all of the Economic Research Service); Charles Cunningham (Agricultural Stabilization and Conservation Service); Henry Wagley and John Reddington (Foreign Agricultural Service); Philip Miller (Agricultural Research Service); O. A. Cleveland (Mississippi State University); and Russell Barlowe (World Agricultural Outlook Board). The authors especially appreciate the excellent editorial services provided by Lindsay Mann and James Sayre (Economics Management Staff) and the assistance of Gail Johnson and Brenda Powell in preparing this report.

Washington, DC 20005-4788 June 1987

Additional copies of this report ...

can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Ask for The U.S. Cotton Industry (AER-567). Write to the above address for price and ordering instructions. For faster service, call the GPO order desk at 202-783-3238 and charge your purchase to your Visa, MasterCard, Choice, or GPO Deposit Account. A 25-percent bulk discount is available on orders of 100 or more copies shipped to a single address. Please add 25 percent extra for postage for shipments to foreign addresses.

Microfiche copies ($6.50 for each report plus $3.00 shipping and handling) can be purchased from the order desk, National Technical Information Service, 5285 Port Royal Road, Springfield, Va 22161. Enclose check or money order payable to NTIS. For faster service, call NTIS at 703-487-4650 and charge your purchase to your Visa, MasterCard, American Express, or NTIS Deposit Account. NTIS will ship rush orders within 24 hours for an extra $10; charge your rush order by calling 800-336-4700.

The Economic Research Service has no copies for free mailing.

CONTENTS

Page

HIGHLIGHTS

U.S. farmers produced about 17 percent of the world's cotton in 1985, down from about 31 percent in 1960. During that same time, cotton's share of the world textile fiber market dropped from nearly 70 percent to about 50 percent. The United States, China, and the Soviet Union account for about 60 percent of production. Although total harvested acreage in the United States dropped by about 33 percent between 1960 and 1985, production dropped by less than 6 percent because of increased yields. Cotton and other natural fibers have faced stiff competition from manmade fibers during the last 25 years. However, demand for cotton and cotton blends, especially, has recently increased. U.S. cotton producers have frequently been plagued by excess production capacity, high stocks, and low product prices. The future of the U.S. cotton industry will continue to depend heavily on exports, as domestic mill consumption may be constrained by textile imports and competition from manmade fibers.

This report describes all components of the U.S. cotton industry from producers to consumers, and provides a single source of economic and statistical information on cotton. It identifies and describes the structure and performance of the cotton industry, emphasizing the production, marketing, and consumption of raw cotton and cotton products, including a historical overview of Federal farm programs affecting cotton supply.

Cotton is produced in 17 States from Virginia to California, with major concentrations in the Delta area of Mississippi, Arkansas, and Louisiana; the Texas High Plains and Rolling Plains; central Arizona; and California's San Joaquin Valley. Upland cotton accounts for 99 percent of the U.S. crop and is the most commonly grown cotton in other countries. Extra long staple (ELS) cotton, also known as American Pima cotton, is grown in limited areas of southwest Texas, New Mexico, and Arizona.

Cotton has been a major cash crop and important source of foreign exchange in the United States for almost 200 years. Raw cotton is also an important source of foreign exchange for the Soviet Union, China, Egypt, Sudan, Pakistan, Turkey, Mexico, and Guatemala. Although the United States has usually been a competitive exporter of raw cotton, other countries, many of them also cotton producers, are more competitive as exporters of finished products. Since 1960, developing countries in Asia have become major importers of raw cotton for their increasing domestic demand and for their growing textile industries producing cotton fabrics and apparel for export.

Fewer but bigger farms dominate in cotton production. In 1949, 1.1 million farms harvested an average of 24 acres of cotton each. In 1982, 38,000 farms harvested an average of 256 acres of cotton each. Despite this more than tenfold growth in average size, individuals or family businesses control about 80 percent of the cotton farms.

U.S. cotton production has shifted westward. From 1970 to 1985, production in California and Arizona, as a share of total U.S. production, almost doubled from 16 percent to 31 percent. Lower unit costs of production, higher net returns in relation to other crops, flat terrain, good soils, and the availability of irrigation water in the Southwest and West have been the primary reasons for the shift.

The U.S. Cotton Industry

Irving R. Starbird
Edward H. Glade, Jr.
W. C. McArthur
Fred T. Cooke, Jr.
Terry Townsend*

INTRODUCTION

Cotton is the single most important textile fiber in the world, accounting for about 50 percent of total world fiber production. Although some 75 countries produce cotton, China, the Soviet Union, and the United States account for about 60 percent of world production. During 1982-85, the United States produced about 15 percent of the world's cotton and used 8 percent.

Cotton has been a major cash crop and an important source of foreign exchange in the United States for nearly 200 years. Cotton was first grown in the United States at Jamestown in the early 17th century, but it remained a minor crop until 1793 when Eli Whitney invented the cotton gin to separate the seed from the lint. This development spurred production, with most lint being exported to textile mills in England. In 1850, for example, nearly 90 percent of lint production was exported, with the earnings offsetting the costs of about two-thirds of all goods imported into the United States. U.S. exports during 1982-84 accounted for about 30 percent of world cotton trade. Export earnings averaged about $2 billion, or about 5 percent of the total value of U.S. agricultural exports. Exports accounted for about 52 percent of total disappearance (mill use plus exports) of U.S. cotton.

In 1985, cotton ranked fifth ($4 billion) among the major field crops in value of farm production, following corn ($21.3 billion), soybeans ($10.8 billion), baled hay ($9.7 billion), and wheat ($7.7 billion). The farm value of cotton lint and seed accounted for about 5 percent of the value of all principal crops marketed in 1982-85. Cotton acres harvested represented about 3 percent of U.S. total acreage of principal crops harvested.

Cotton production, marketing, and manufacturing affect the lives of many people, from producers through consumers. The 38,000 cotton producers scattered across the Cotton Belt from Virginia to California received about $3.6 billion in 1985/86 from the sale of cotton lint and an added $350 million from the sale of cottonseed. Ginning, warehousing, and marketing also provide significant sources of revenue and employment in local areas. Moreover, many

*Glade and Townsend are agricultural economists in the National Economics Division (NED), Economic Research Service (ERS), U.S. Department of Agriculture, Washington, DC. Starbird, McArthur, and Cooke were associated with NED at the time this research was conducted and have since retired.

producers and retailers of pesticides, fertilizers, and machinery and equipment are involved. Because cotton is a major raw material for the textile and apparel industries, spinners, weavers, finishers, and manufacturers of apparel and household and industrial products depend heavily on the cotton industry. The estimated retail value of domestically produced cotton apparel products alone totals $10-$12 billion a year.

The world cotton industry faces stiff competition from manmade fibers in all major end uses. All natural fibers have lost markets to manmade fibers over the past 25 years. Cotton was the most important fiber used by the American textile industry until the 1960's, when manmade fibers surpassed cotton. Global mill consumption of cotton continues to expand despite the growth in manmade fiber consumption. However, world per capita consumption has changed little over the past 25 years, in contrast to a substantial rise in per capita consumption of total fibers. U.S. mill consumption of cotton, on the other hand, dropped from 9.6 million bales in 1965/66 to about 6.4 million bales in 1985/86. Cotton textile imports have nearly doubled since 1980, partly in response to the strength of the U.S. dollar and of the U.S. economy in relation to foreign economies. This loss of domestic markets and greater reliance on export markets has increased the price volatility of U.S.-produced cotton.

Since the turn of the century, U.S. cotton producers have frequently experienced excess productive capacity, high stocks, and low prices. The health of the U.S. cotton industry is highly interdependent with the world economy. Raw cotton exports averaged more than 50 percent of U.S. production during 1982-84, but have varied greatly depending on foreign cotton output and general economic conditions. The United States has tended to be a residual supplier of cotton in world trade, contributing to supply and price instability. Government programs since the early 1930's have attempted to provide an income "safety net" for producers and promote needed resource adjustments.

This report updates and revises an earlier report on the cotton industry's structure, practices, and costs (11). 1/ Three new sections on demand for raw cotton, cotton pricing systems, and textile and apparel manufacturing explain the market forces affecting demand for cotton. This report identifies and describes the structure and performance of the cotton industry, emphasizing the production and marketing of raw cotton, and explores the underlying economic and political forces causing change in the various segments of the industry.

BRIEF HISTORY OF COTTON

Cotton is a perennial plant grown as an annual in the United States, in contrast with perennial growth in some frost-free areas of South and Central America. The English word "cotton" was derived from the Arabic word "quoton" (1, p. 155).

Although the origin of cotton and the time of first use are unknown, cotton was probably one of the first natural fibers used by man, perhaps predated by only flax and wool. Archeologists have discovered fragments of woven cotton

1/ Underscored numbers in parentheses identify sources cited in References at the end of this report.

fiber dating back to 3500 B.C. in Mexico, 2700 B.C. in the Indus Valley of Pakistan, and 2500 B.C. in Peru (10). Earlier use is difficult to establish because of fiber decay, especially in moist areas. Modern Upland cottons are apparently derived from domesticated forms of G. hirsutum grown in southern Mexico and Guatemala (10). Early explorers found cotton growing in Brazil, Peru, and Mexico at the beginning of the 16th century. Columbus reportedly found cotton growing and woven cotton fabrics in the West Indies. However, early European settlers did not find domesticated cotton in the United States.

Cotton Types

Cotton, genus Gossypium, includes both cultivated (linted) species and wild (lintless and noncommercial) species. The predominant type of cotton grown in the United States, Gossypium hirsutum, is known as American Upland cotton (2). It typically accounts for about 99 percent of the U.S. cotton crop and is grown in most major cotton producing countries. Another type of cotton grown in limited areas of the United States, Gossypium barbadense, is commonly referred to as American Pima or extra long staple (ELS) cotton. The fiber (lint) of Upland varieties usually ranges in staple length from 7/8 inch to about 1-1/4 inches; ELS lint generally ranges from 1-3/8 inches to 1-3/4 inches. Upland cotton is grown throughout the U.S. Cotton Belt, while ELS cotton is grown chiefly in west Texas, New Mexico, and Arizona. The production of ELS cotton is small in relation to that of Upland cotton because its production costs per pound are higher and its markets are chiefly high-value products such as sewing thread and expensive apparel items.

Upland cotton is thought to derive its name from its early location in the interior or "uplands" of the Carolinas and Georgia, in contrast to Sea Island cotton which was then grown in the "lowlands" or coastal areas of those States (2). Sea Island cotton was introduced from the West Indies about 1785, but it never developed as an important commercial species in areas other than the coastal lowlands. No Sea Island cotton is now grown commercially in the United States.

The first commercial American strain of ELS cotton was produced in 1912 in the Salt River Valley of Arizona and the Imperial Valley of California. Its origin was extra long staple Egyptian cotton.

Although no cottons are true annuals, the U.S. commercial cotton crop is, with few exceptions, produced from annual seedings.

Development of the U.S. Textile Industry

Colonists of Virginia and South Carolina first grew cotton in the early 1600's using seed stocks from the West Indies (1, p. 74). Although cotton has been grown continuously in the United States since about 1620, cotton production and marketing did not become commercially feasible in the United States until the saw gin was invented and new varieties from Mexico were introduced, both around 1800. At the same time, advanced English yarn-spinning methods were introduced into the United States by Samuel Slater. Previously, cloth production had been chiefly a home industry, with wool and linen as the major fibers used in clothing.

In the 18th century, England held a textile industry monopoly, resulting from inventions like John Kay's flying shuttle, which more than doubled a weaver's capacity, and James Hargreaves' spinning jenny, which increased yarn production eightfold. Water power replaced hand power with Sir Richard Arkwright's invention of the "water frame," a spinning machine. In the late 18th century, Edmund Cartwright mechanized weaving with his power loom (10).

Severe English laws prohibited the export of any machines, plans, or tools for them, and the emigration of textile mechanics. Samuel Slater, who worked as an apprentice in a leading English textile mill, memorized details for the Arkwright water frame and other machinery. In 1789, he traveled to Pawtucket, Rhode Island, where he built and operated a mill for the Almy Brown textile firm. Slater's tiny spinning mill launched the U.S. textile industry and ignited the American Industrial Revolution. Slater, Almy Brown, and others soon built more cotton mills.

These mills did the spinning, but contracted the weaving of yarn into cloth to individuals or small groups until 1813, when Francis Cabot Lowell introduced a practical power loom. Lowell's factory in Massachusetts was the first textile mill in America where all operations from the opening of cotton bales to producing finished cloth were mechanized and performed under one roof. It was the forerunner of today's vertically integrated textile plant.

The newly mechanized mills operated below capacity because of short supplies of cotton fiber. Prior to the invention of the saw gin, most of the cotton lint was removed from the seed by hand. One person could separate only 1-2 pounds of lint per day. Under such circumstances, other farm enterprises were more profitable. The few gins in use prior to 1793 were roller gins similar to those used in India, but those gins were not suitable for ginning the Upland cotton varieties best adapted to U.S. growth. Eli Whitney invented the saw gin in 1793, which at that time could do the work of 50 people.

The cotton industry expanded quickly following introduction of the saw gin, from production of 10,000 bales in 1793 to 126,000 bales 10 years later. During the 19th century, the commercial production of cotton expanded westward from Virginia, the Carolinas, Georgia, and Florida to the Midsouth, Texas, and Oklahoma. During the early 20th century, cotton became an important crop in California, Arizona, and New Mexico.

The increased demand for cotton following development of the saw gin brought a rapid expansion in the number of textile mills. By 1847, more people worked in textiles than in any other industry. Another significant development was the invention of a cotton sewing thread, which was stronger and smoother than linen thread.

The replacement of water power with steam engines permitted the location of textile mills away from waterways. After the turn of the 19th century, the textile industry began expanding to the South from New England in order to be closer to the source of cotton. This expansion shifted population from rural to urban areas and brought industry to the rural South.

The textile industry's continued growth gave birth to new inventions and spawned other industries. The sewing machines invented by Walter Hunt and Elias Howe were followed by Isaac Singer's more sophisticated model. This model, mass produced by a technique developed by Eli Whitney, resulted in the establishment of the vast apparel industry.

The textile industry's needs for more efficient and durable machinery were met by innovations which improved iron and steel processing. Fuel needs were first supplied by water power and then by the coal industry, which provided power, heat, and light. However, textiles and other industries soon realized the potential of petroleum for fuel and power. Electricity has replaced steam and coal byproducts for powering and lighting textile mills. Natural gas has become an essential process fuel in fabric manufacturing. Today, petroleum is also the primary raw material for production of 80 percent of the synthetic fibers used in textiles, although only a small fraction of the Nation's oil supplies are used for this purpose.

Even as the textiles industry gave birth to other industries, its own growth was nurtured and accelerated by other industrial pioneers like Henry Ford and Charles Goodyear. The automobile maker, his competitors, and their successors became the textile industry's largest single group of industrial customers for textile products. Goodyear discovered how to vulcanize rubber, but the textile industry developed the cord which reinforces pneumatic tires. The textile industry has also fashioned fabrics ranging from flame-resistant carpet for jet planes to suits for astronauts and heat shields for their reentry craft.

The character of textiles changed drastically with the introduction of manmade fibers, the first being rayon in the 1920's. Beginning in the 1930's, this development resulted in fibers known today by their generic names -- nylon, polyester, olefin, and acrylic. These fibers, used alone or in blends with each other or natural fibers, have dramatically changed the fashion, fit, and function of fabrics. The textile industry also has entered the age of technology, using computers and electronics to develop better ways to make new and better textiles.

COTTON SUPPLY

Cotton is produced in 17 States from California to Virginia, with major concentrations in the Delta areas of Mississippi, Arkansas, and Louisiana; the Texas High Plains and Rolling Plains; central Arizona; and the San Joaquin Valley of California (fig. 1). This section includes trends in acreage and production, location and characteristics of farms growing cotton, production practices and regional costs, and farm sector costs and returns.

Trends in Acreage, Yields, and Production

U.S. cotton acreage increased from less than 8 million acres at the end of the Civil War to more than 44 million acres in the mid-1920's. Production over that period ranged from about 2 million bales in 1866 to about 18 million bales in 1926. Cotton yields averaged about 180 pounds per harvested acre and rarely exceeded 200 pounds during the 1866-1930 period.

Planted cotton area dropped from more than 40 million acres in 1930 to about 10 million acres in 1966. Yields, however, increased from 269 pounds in 1950 to 527 pounds in 1965, about 4.5 percent annually (fig. 2). Between 1966 and 1980, however, both acreage and yields fluctuated greatly and showed no

Figure 1

Cotton Harvested: 1982

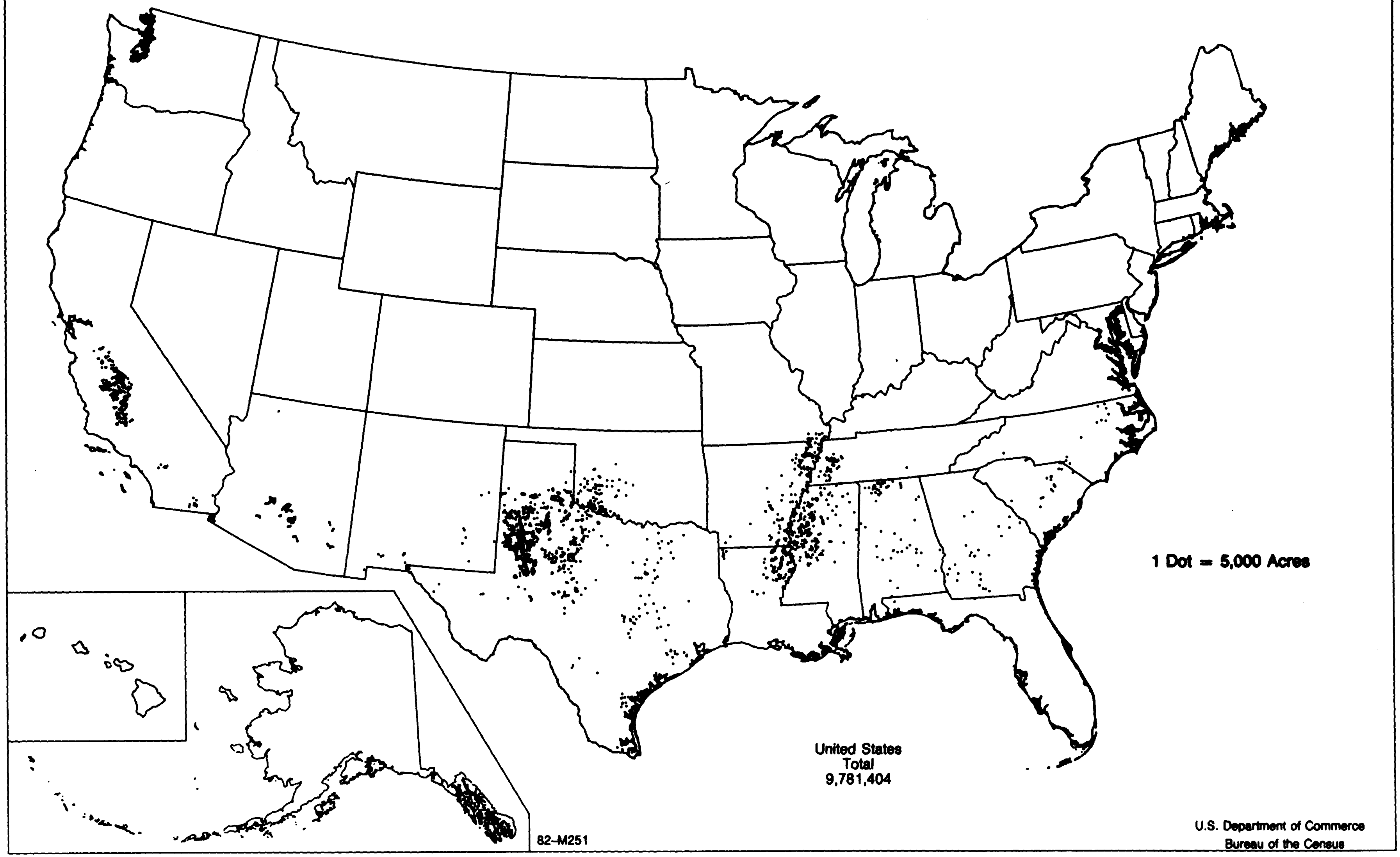
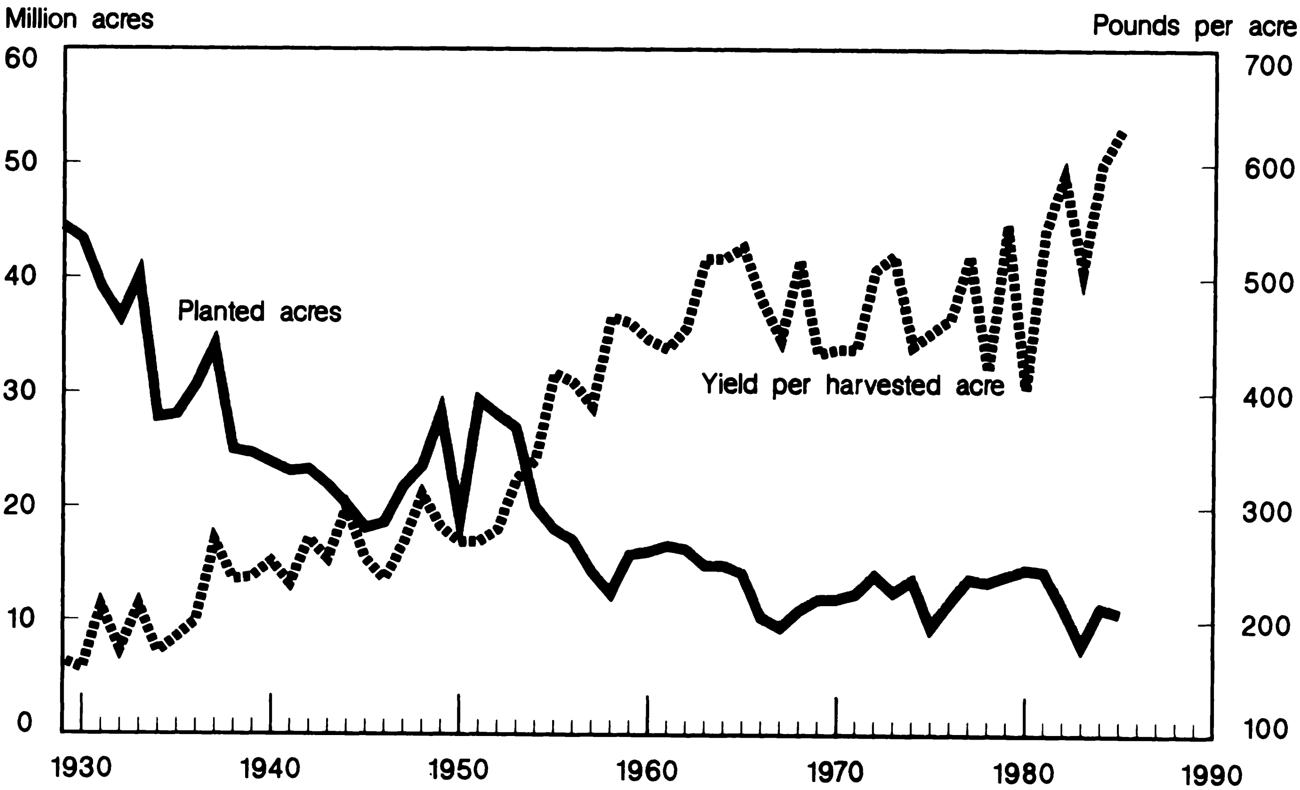


Figure 2
U.S. cotton acreage and yield



obvious trend. Yields reached record-high levels in 1982 and again in 1984 and 1985 (table 1). Some of the increase in yield is attributed to the higher proportion of the crop in recent years on land well adapted to cotton production. Most of the increase, however, is probably because of improved technology and management and because a higher proportion of the crop is being produced on irrigated land.

While Government programs and prices of cotton and competing crops have influenced acreage, weather has been the chief determinant of year-to-year variability in yields. U.S. production has averaged more than 12 million bales a year during the past decade fluctuating from a low of 7.7 million

Table 1--Cotton acreage harvested, yield per harvested acre, and production, by region

Item/crop year 1/	Southeast 2/	Delta 3/	Southwest 4/	West 5/	United States 6/
			1,000 acres		
Acreage:					
1965	2,280	3,974	6,293	1,068	13,615
1970	1,375	3,355	5,487	938	11,155
1975	690	2,616	4,317	1,173	8,796
1976	898	3,611	4,913	1,492	10,914
1977	808	3,388	7,129	1,949	13,275
1978	574	2,862	6,936	2,028	12,400
1979	613	2,412	7,552	2,254	12,831
1980	672	2,846	7,565	2,132	13,215
1981	764	2,943	7,971	2,163	13,841
1982	623	2,381	4,847	1,882	9,734
1983	470	1,683	3,930	1,264	7,347
1984	697	2,629	5,174	1,879	10,379
1985	807	2,595	5,092	1,735	10,229
			Pounds per acre		
Yield:					
1965	453	610	401	1,112	527
1970	410	546	310	846	438
1975	422	457	293	1,050	453
1976	413	382	348	1,083	465
1977	313	542	411	967	520
1978	473	493	297	725	420
1979	501	609	392	1,013	547
1980	355	409	232	1,021	404
1981	541	554	376	1,142	542
1982	749	747	302	1,082	590
1983	415	564	323	1,042	508
1984	722	701	370	1,047	600
1985	741	689	407	1,148	630
			1,000 bales		
Production:					
1965	2,150	5,051	5,262	2,475	14,938
1970	1,175	3,819	3,545	1,653	10,192

See footnotes at end of table.

Continued --

Table 1--Cotton acreage harvested, yield per harvested acre, and production, by region--Continued

Item/crop year 1/	Southeast 2/	Delta 3/	Southwest 4/	West 5/	United States 6/
			1,000 bales		
1975	607	2,491	2,636	2,567	8,302
1976	773	2,874	3,565	3,368	10,580
1977	527	3,827	6,109	3,927	14,389
1978	566	2,939	4,288	3,063	10,856
1979	639	3,061	6,172	4,757	14,629
1980	498	2,424	3,664	4,536	11,122
1981	862	3,394	6,244	5,146	15,646
1982	972	3,707	3,049	4,235	11,963
1983	406	1,979	2,643	2,743	7,771
1984	1,049	3,842	3,992	4,098	12,982
1985	1,246	3,723	4,313	4,151	13,432
			Percent		
Regional shares of U.S. production:					
1965	14.4	33.8	35.2	16.6	100.0
1970	11.5	37.5	34.8	16.2	100.0
1975	7.3	30.0	31.7	30.9	100.0
1976	7.3	27.2	33.7	31.8	100.0
1977	3.7	26.6	42.5	27.3	100.0
1978	5.2	27.1	39.5	28.2	100.0
1979	4.4	20.9	42.2	32.5	100.0
1980	4.5	21.8	32.9	40.8	100.0
1981	5.5	21.7	39.9	32.9	100.0
1982	8.1	31.0	25.5	35.4	100.0
1983	5.2	25.5	34.0	35.3	100.0
1984	8.1	29.6	30.7	31.6	100.0
1985	9.3	27.7	32.1	30.9	100.0

1/ Year beginning August 1.
2/ Virginia, North Carolina, South Carolina, Georgia, Florida, and Alabama.
3/ Missouri, Arkansas, Tennessee, Mississippi, Louisiana, Illinois, and Kentucky.
4/ Texas, Oklahoma, and New Mexico. Includes a small quantity of ELS cotton.
5/ California, Arizona, and Nevada. Includes a small quantity of ELS cotton.
6/ Totals may not add due to rounding.

Source: (24).

bales in 1983, when the payment-in-kind (PIK) program greatly reduced acreage, to a high of 15.6 million bales in 1981.

Following its introduction in Arizona and California in 1912, the acreage of ELS cotton expanded greatly until 1920, when about 240,000 acres were planted. ELS acreage dropped to about 40,000 acres in 1923 and remained relatively low during the 1930's. Acreage expanded greatly in the early 1940's because of wartime purchase programs, reaching about 193,000 acres in 1942. Planted acreage during 1944-49 averaged less than 10,000 acres annually. Wartime incentives had ended, imports were higher, stocks were increasing, and the Government had ended acreage allotments on Upland cotton. ELS purchase programs in 1951 and 1952 and relatively high support prices thereafter have maintained ELS cotton in the 50,000 to 100,000-acre range in most years since 1950. Planted area averaged about 75,000 acres during 1982-85, and annual production averaged about 118,000 bales (app. table 10).

U.S. cotton production has continued to shift westward. In 1985, the West (California and Arizona) accounted for about 31 percent of U.S. output, up from 16 percent in 1970 (table 1). In contrast, shares of the Southeastern and Delta States have declined. The Southwest (Texas, New Mexico, and Oklahoma) and the West accounted for more than 60 percent of U.S. cotton production in 1982-85. The regional shift was mainly because of lower average unit production costs and higher net returns in relation to other crops in the West and Southwest in the 1970's, and the elimination of marketing quotas and the original historical acreage allotments. Virtually all cotton acreage in the West is irrigated, and yields are usually more than double dryland yields elsewhere.

Factors Affecting Location of Production

Production depends on many factors, including soil productivity, climate, cost of production, market conditions, and Government programs. The mix and relative strength of these forces are never static. Individual producing regions are, consequently, always subject to shifts in the resources used for crop and livestock production. In the long run, location of production is determined chiefly by economic factors, which are influenced by all the physical factors. This section focuses on several factors influencing location of cotton production.

Physical Factors

The physical environment, including soil, climate, topography, and other components, establishes the range of production possibilities in a given area. The individual and combined effects of these physical factors determine to a large extent what commodities can be produced as well as production efficiency.

Soils. Soil characteristics and topography were important factors in the historical development of U.S. cotton production. In many cases, cotton production in the 1950's and 1960's shifted to areas having an advantage in soil fertility. For example, the Delta and the western irrigated areas contain primarily alluvial soils. The Delta retained its relatively large share of the U.S. cotton acreage during those two decades, while the western irrigated areas gained an increasingly larger share of production. Relative shares declined in such areas as the Southeast and Texas Blacklands where much of the land had become less productive because of soil erosion and other factors.

On the other hand, cotton continues to be planted in some areas that do not have outstanding soils for cotton production. In those areas, forces other than soils, such as technology, commodity prices, or Government programs, had the greatest influence. Cotton has gravitated to those soils where production could be more easily managed. Cotton production in the past was kept on less fertile soils in some areas because of acreage controls. The removal of Government program restraints on production during the 1970's has facilitated shifts in the location of cotton production. [For an overview of soils acceptable for cotton, see Waddle (38, pp. 236-48).]

Topography. Topography may have exerted more influence on shifts in location of cotton production during the last quarter century or more than any other factor (11, p. 7). While there is no satisfactory quantitative measure of the effects of topography, the movement of cotton production from hilly land to relatively flat terrain suggests a significant relationship between production shifts and topography. For example, topography is a major factor in the Southeast. By the end of the 1960's, most of the cotton remaining in this region had moved from the Piedmont to the relatively flat Coastal Plain areas.

Most of the Delta cotton production is located in the alluvial valley or stream bottom lands which traverse the area. This region has accounted for a large share of the Nation's cotton acreage and production over the last three decades.

Cotton has virtually moved out of the hilly areas of eastern Oklahoma and south Texas. The Texas Blackland area, while only moderately rolling, has lost cotton acreage sharply since the 1940's largely because of cotton disease problems, off-farm employment opportunities, and increased livestock farming in the area. All Texas High Plains producing areas, on the other hand, are flat to gently undulating. These areas have increased their share of the U.S. cotton acreage substantially since the early 1950's. For example, the acreage planted to cotton in the Texas-New Mexico High Plains increased from about 10 percent of the national cotton acreage for the 1950-52 period to almost 31 percent for the 1982-84 period (table 2). The irrigated areas of the West

Table 2--Distribution of U.S. cotton acreage and production by regions and specified areas 1/

Region/area	Share of total U.S. cotton acreage			
	1950-52		1982-84	
	Planted	Production	Planted	Production
	Percent			
Southeast	18.5	19.5	6.0	7.4
Delta	26.1	32.4	22.5	29.1
Alluvial valley	11.2	14.9	12.4	18.0
Other areas	14.9	17.5	10.1	11.1
Southwest	48.8	31.2	54.8	29.6
High Plains	10.5	7.9	30.7	15.0
Other areas	38.3	23.3	24.1	14.6
West	6.6	16.9	16.7	33.9

1/ Based on county data from the National Agricultural Statistics Service, USDA.

also have relatively flat topography. These areas also gained an increasing share of the national acreage during the same period.

Temperature. The boundaries of the Cotton Belt are determined by national boundaries on the east, south, and west, and by frost-free periods and average temperatures on the north. Commercial cotton production generally requires about 200 days between killing frosts and a minimum summer average temperature of 77° Fahrenheit. The northern limits marking these two phenomena approximately coincide across most of the country. Mean length of the frost-free period across the United States is indicated in figure 3. Although a 200-day line is not shown, its general outline is roughly suggested by an interpolation using the 180-day and 210-day lines.

Although cotton is a heat-loving plant well-adapted to tropical latitudes, more than 50 percent of the world crop is grown in temperate zones above latitude 30° North. In the United States, some cotton is grown close to latitude 37° North (38). Cotton varieties grown in the Soviet Union require somewhat fewer frost-free days and are grown chiefly between latitudes 37° and 42° North. The only other cotton area in the world producing cotton north of latitude 40° North is in northeast China.

Cotton yields tend to decrease as production approaches the Cotton Belt's northern limits. Table 3 data show yield comparisons, based on 15-year median yields, for most northern areas across the Cotton Belt with comparable resource areas immediately south. While other factors undoubtedly are involved, there is little doubt that the lower yields in the northern areas are partly associated with higher risks of loss from late spring and early fall freezes. Conversely, yields of the strongest competitor crops, mostly grains, tend to increase in most of these border areas from south to north.

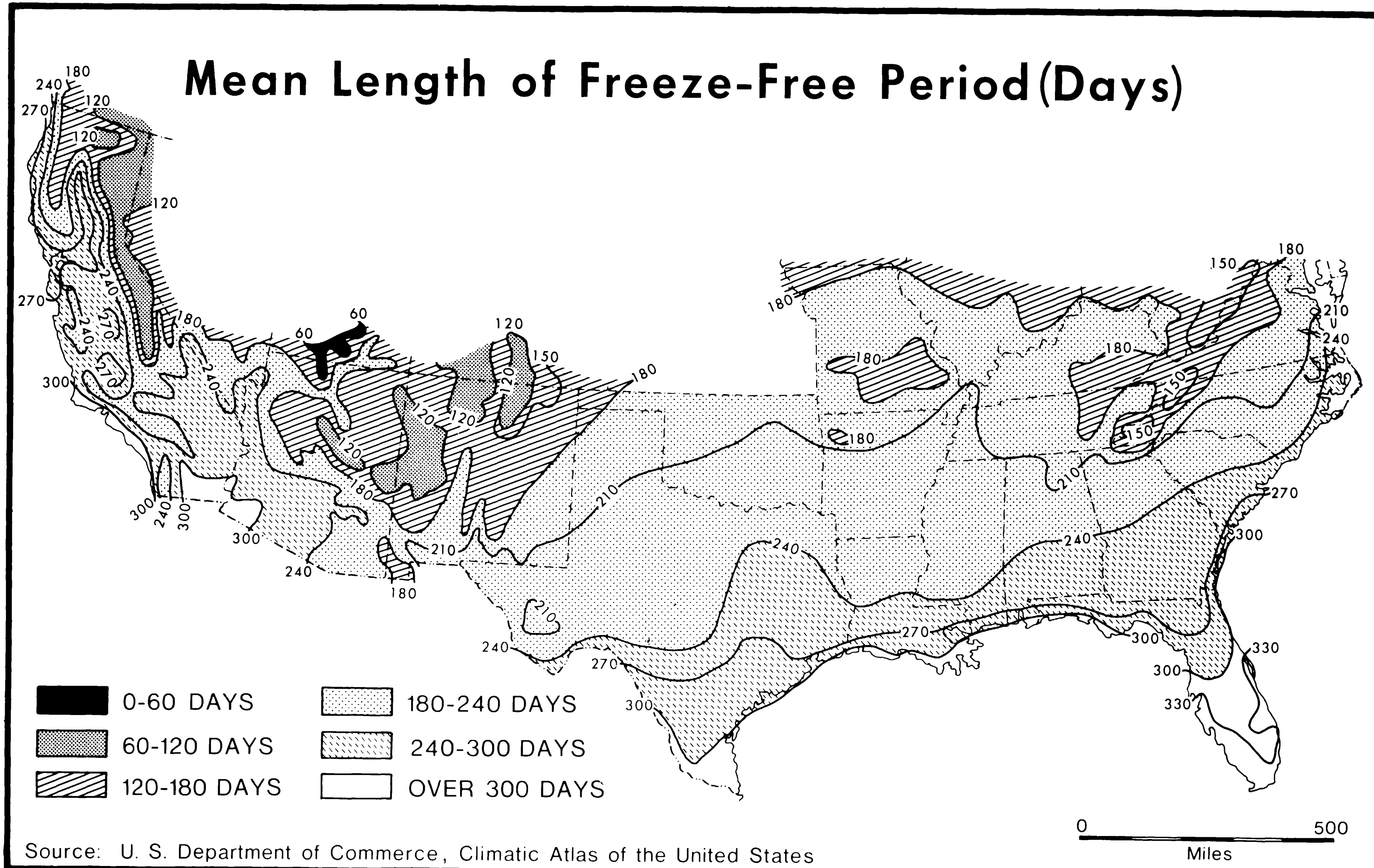
Table 3--Cotton yield comparisons between selected northern and southern Cotton Belt areas

Subregion	Lint per acre	
	Northern area	Southern area
	Pounds	
Coastal Plains 1/	344	428
Brown Loam 2/	513	550
Delta 3/	523	575
Rolling Plains 4/	269	293
High Plains 5/	444	533

1/ Coastal Plains areas of North Carolina, South Carolina, and Alabama.
2/ Tennessee Brown Loam area compared with Mississippi Brown Loam.
3/ Northern area includes Missouri boot heel and southern area includes the Arkansas Delta area.
4/ Northern Rolling Plains area in Oklahoma compared with Southern Rolling Plains area in Texas.
5/ Northern High Plains of Texas compared with the Central High Plains of Texas.

Source: (11).

Figure 3


Mean Length of Freeze-Free Period (Days)
0-60 DAYS
60-120 DAYS
120-180 DAYS
180-240 DAYS
240-300 DAYS
OVER 300 DAYS
Source: U. S. Department of Commerce, Climatic Atlas of the United States
0
500
Miles

Rainfall. Most cotton grown east of the 40-inch annual rainfall line shown in figure 4 is not irrigated. Cotton farmers in this zone generally use a relatively high level of production inputs and aim for a high yield. Total rainfall in the eastern zone is more than adequate for cotton production at high yield levels. Distribution of rainfall is much less favorable and less predictable than total rainfall. At any location and in almost every year, yield is adversely affected by too little or too much rainfall at some time during the growing season. Excessive rainfall is more common than insufficient rainfall. However, droughts also occur. Nevertheless, yield expectations are relatively high for the eastern zone, but yields vary by areas because of differences in soil resources as well as other factors.

The zone between the 40-inch and the 16-inch average annual rainfall lines includes most of the cotton production areas in Texas and Oklahoma. Cotton is usually irrigated, at least on a supplementary basis, in the lower rainfall range of this zone, encompassing the High Plains areas and the lower Rio Grande area. Large acreages of nonirrigated cotton are also located in the High Plains and lower Rio Grande areas. In other areas within the 16- to 40-inch zone, much of the cotton is nonirrigated.

Most of the nonirrigated cotton produced in this intermediate rainfall zone receives comparatively low levels of production inputs. Yield expectations are correspondingly low. Rainfall distribution is generally erratic and the risk of drought is much greater in this zone than in the eastern, higher rainfall zone. Acreage abandonment after planting is also higher than in other regions.

Production-input use and yield expectations in the intermediate rainfall zone are considerably higher on irrigated than on nonirrigated land. However, input use and yields are much lower than in the irrigated cotton areas in the West. Although irrigation water is limited in much of the High Plains, the incidence of risk from other factors, chiefly related to the length of the growing season, discourages high input-use levels.

All cotton in areas receiving less than 16 inches of rainfall is irrigated. Production-input use and cotton yield expectations are very high, except for the Southwest irrigated cotton area.

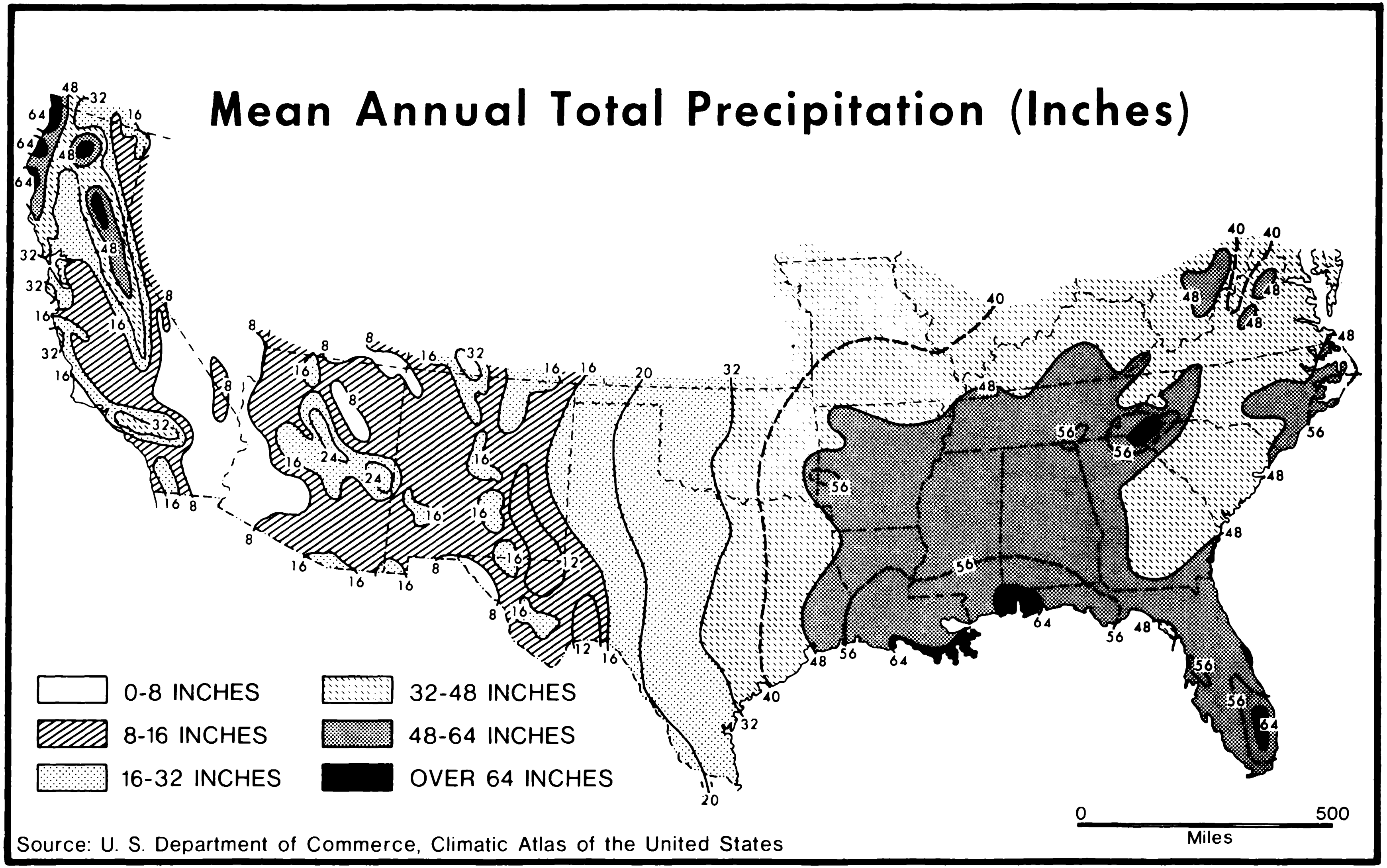
Rainfall has affected the nature and methods of cotton production in the various producing regions. Variations in rainfall also affect the competitiveness of cotton with other crops. For example, cotton has appeared much more sensitive to competition from other crops in some of the nonirrigated portions of the central zone than in most higher rainfall and irrigated areas since removal of acreage controls.

Economic Factors

Since the late 1940's, strong economic and technical pressures have led to increased farm size. In 1949, more than 1.1 million cotton farms averaged 24 acres of cotton per farm. Almost two-thirds of the farms had less than 15 acres of cotton. On a majority of these farms, the family provided almost all of the labor, setting the upper bound on the size of operation.

Mechanization of cotton farming was still in its early developmental stages in 1949. Animal power remained the only source of power on a majority of farms producing cotton. Less than a third of the farms growing cotton had

Figure 4



Source: U. S. Department of Commerce, Climatic Atlas of the United States tractors. Although tractors were used on many farms for land preparation and cultivation, the critical and peak labor requirements remained for hand hoeing and hand harvesting. The mechanical harvester had been developed, but it had not been widely adopted, partly because the existing size structure could not support it. The use of mechanical harvesters increased greatly during the 1950's, involving about half the U.S. crop by 1960. By 1970, virtually all of the U.S. crop was mechanically harvested. Mechanization of other field operations progressed rapidly in response to increasing labor costs, labor shortages, and the need to perform more timely operations on larger acreages. Chemical weed control, which became common in the 1950's, has largely replaced hand hoeing, reducing labor requirements for this operation.

During the 1950's, the United States entered a period of sustained inflation and rising economic expectations that accelerated during the 1970's and then slowed in the early 1980's. Per capita disposable income increased almost eightfold in nominal dollars from 1950-84. In real terms (1972 constant dollars, for example), per capita disposable income about doubled during 1950-84. At the same time, prices paid by farmers increased sharply, particularly during the 1970's, and the consumer price index rose about 330 percent. Cotton prices increased only about 63 percent for the same period (1950-52 to 1982-84).

The cost-price squeeze, particularly since 1970, has forced producers to reduce production costs. Many producers chose to enlarge the size of operations as a way to lower unit costs and increase income. At the same time, many marginal producers discontinued production because of increasing costs and the removal of allotments and loss of certain program benefits to small producers. Thus, in areas that retained cotton, the number of producers dropped and farm size increased. About 38,000 farmers grew cotton in 1982, compared with nearly 200,000 farms in 1969 (34). Harvested area per farm increased from 58 acres in 1969 to 256 acres in 1982. Cotton production has tended to gravitate to flat or gently sloping areas as cotton farms became fewer and larger. The relatively level terrain and large-scale farming in these areas enhance the adoption and use of large multirow machinery.

Location of cotton production depends not only on the absolute advantages, such as lower production costs or higher returns, but also on comparative advantage, or how net returns from cotton compare with those of alternative crops or other uses of resources. Net returns from cotton have generally exceeded returns from competitive crops since 1980 in the major cotton-producing areas such as the alluvial valley areas of the Delta region, the Texas High Plains and Rolling Plains areas of Texas and Oklahoma, central Arizona, and the San Joaquin Valley (20).

Cotton's major competitors in the Southeast are soybeans and corn. Nearly 6.7 million acres of soybeans, or 10 percent of the U.S. acreage, were harvested in the Southeast in 1984, compared with 697,000 acres of cotton and 3.4 million acres of corn for grain. Soybeans have recently accounted for about 40 percent of the total acreage of principal crops planted in the Southeast. Soybean acreage has increased sharply in both the Southeast and the Delta since the early 1960's. In the Southeast, net cash returns from soybeans and corn are near those from cotton on many farms, and cotton acreage is sensitive to price as well as Government programs. Peanuts and tobacco have historically yielded higher net returns per acre than cotton in the Southeast. But, because their acreage has been controlled by allotments, their effect on cotton acreage has been small.

Although cotton acreage and production in the Southeast have dropped sharply over the past two decades, average yields have increased substantially since 1980, partly due to the boll weevil eradication program. The remaining production appears to be competitive with other regions and with other enterprises within the Southeast in terms of returns above cash costs (table 4). However, new technologies or equipment that require larger scale operations may continue to favor other regions.

Cotton's major competitor in the Delta is soybeans. Its acreage has increased sharply since 1960, rising from about 4 million acres in 1960 to 10 million acres in 1984. Soybeans have recently accounted for more than 50 percent of the total acreage of principal crops planted in the Delta. Cotton has been planted on 8-10 percent of the planted acreage in the Delta, with much higher concentration in the alluvial valley areas. In the alluvial valley areas, cotton and soybeans are the major competitors on the well-drained mixed and sandy soils, while rice has been the most profitable crop on the clay soils. Much of the most productive rice land is the least productive cotton land in the Delta.

For the average Delta producer, net returns per acre from cotton are much higher than from soybeans. Most of the production in this region is concentrated in the alluvial valley areas where cotton will continue to compete favorably with other enterprises and with other regions.

Table 4--Returns above cash costs per acre for cotton and selected crops in cotton-producing regions 1/

Region/crop	Returns per acre above cash costs					
	1980	1981	1982	1983	1984	1985
	Dollars					
Southeast:						
Cotton	21	19	95	-20	119	87
Soybeans	21	32	25	32	38	27
Corn	7	12	3	24	60	29
Delta:						
Cotton	97	49	118	124	92	73
Soybeans	42	33	36	74	65	37
Rice	94	139	16	78	93	144
Southwest:						
Cotton	33	23	3	54	36	46
Sorghum	40	35	16	37	34	24
Wheat	28	21	21	42	20	10
West:						
Cotton	405	147	101	197	103	108
Wheat	101	48	*	-15	-23	-14
Barley	37	23	-9	-2	25	-24

* = Less than $1.

1/ Returns exclude Government payments. Costs exclude hired labor.

Source: (20).

In Texas, Oklahoma, and New Mexico, grain sorghum and winter wheat are cotton's major competitors. In 1984, the Southwest accounted for about 50 percent of the U.S. cotton acreage, 30 percent of the grain sorghum acreage, and 16 percent of the wheat acreage. Texas accounted for as much as 60 percent of U.S. sorghum production in the early 1950's, but its relative importance diminished to about 25 percent by 1984.

Although cotton and wheat acreage and production in the Southwest fluctuate greatly from year to year, the Southwest has maintained its relative shares of production since the mid-1960's. Oklahoma and Texas are both major producers of wheat, while Texas produces more than 90 percent of the region's cotton. In 1984, wheat accounted for about 53 percent of the region's acreage of principal crops planted. Cotton and sorghum accounted for about 20 percent and 17 percent.

Given current price relationships, cotton will remain competitive with competing crops in the Southwest, especially at current and prospective target price levels. Although net cash returns per acre in the Southwest usually average below those of other regions, the larger size of farms, fewer crop alternatives, and established cotton markets tend to maintain cotton production in this region.

Wheat, barley, and alfalfa hay are cotton's chief competitors in the West. In 1984, California and Arizona accounted for about 18 percent of the U.S. cotton acreage, 5 percent of the barley acreage, 4.4 percent of the alfalfa acreage, and 1.4 percent of the wheat acreage. In 1984, cotton accounted for about 32 percent of the region's total acreage planted in principal crops, while alfalfa accounted for about 20 percent, wheat for 17 percent, and barley for 10 percent. Cotton in the West has accounted for an increasing share of the U.S. cotton acreage and production in response to high yields, consistently high quality, and relatively high prices and net returns. Wheat and barley are distant competitors in the West in terms of returns above cash costs. The highest average returns above cash costs per acre during 1980-84 were obtained from cotton in the West.

Government Programs

Government programs since the early 1930's have attempted to support prices and adjust acreage and production to market needs (25). Cotton programs during 1933-65 frequently included acreage allotments, marketing quotas, and parity price supports. Those programs tended to freeze resources in existing use patterns. Cotton programs since 1966 have been more market oriented, featuring price supports based on world price levels and direct payments to participating producers when market prices were low. Planted acreage and production have changed significantly over the years following the adoption of new programs. The acreage planted to cotton dropped sharply under programs of the 1930's from the high levels of the late 1920's. Although cotton acreage continued a downward trend, the rigidities of the acreage allotment-marketing quota system remained in effect essentially through the mid-1960's. The Food and Agriculture Act of 1965 permitted, for the first time, the sale and lease of allotments within a State. This encouraged a shift from high-cost to low-cost producers within a State. The suspension of marketing quotas by the Agricultural Act of 1970 gave further impetus to the transition of small or noncompetitive producers out of cotton production, especially in the Southeast and hilly areas of the Midsouth. Unlike previous programs, the farm cotton allotment for the 1971 and succeeding crops placed no limits on the acreage of cotton that a participant could plant, thereby allowing efficient producers to increase their cotton acreage without penalty.

The Food and Agriculture Act of 1977 provided a target price calculation based on acreage actually planted rather than on an historical allotment. The intent of the 1977 Act was to establish a price and income safety net for producers and, at the same time, provide for the desired market orientation. Elimination of the historical acreage allotment facilitated a further shift of cotton production to lower cost regions of the West and Southwest because benefits were based on recent plantings. This change encouraged the movement of acreage to efficient producers and to regions where cotton held a comparative advantage. However, market forces rather than Government programs have been the primary determinants of shifts in the location of production.

Characteristics of Farms Growing Cotton

The number of farms harvesting cotton declined dramatically from 1949 to 1982 (table 5). In 1949, when mechanization was still in its early developmental stages, the average cotton farm harvested 24 acres of cotton, a small percentage of the 1982 average (table 5). Cotton area harvested per farm in 1982 ranged from 111 acres in North Carolina to 441 acres in Arizona (table 6). About 58 percent of the farms harvesting cotton in 1982 reported 100 or more acres of cotton and they accounted for 94 percent of total production. Farms reporting 250 or more acres of cotton accounted for 31 percent of all farms and about 80 percent of total production (table 7). About 36 percent of all farms harvesting cotton in 1982 reported total sales of farm products of $100,000 or more. On the other hand, about one-fourth reported total sales of less than $20,000.

Table 5--Number of farms growing cotton and harvested cotton acreage for specified Census years

Year	Farms growing cotton	Harvested cotton acreage: Total	Harvested cotton acreage: Per farm
	Number	Million acres	Acres
1949	1,110,876	26.6	24
1969	199,784	11.5	58
1974	89,536	12.2	137
1978	52,628	12.7	241
1982	38,266	9.8	256

Source: (31).

Table 6--Number of farms harvesting cotton and acres of cotton per farm, by region and State

Region/State	1974 Farms	1974 Cotton acreage per farm	1982 Farms	1982 Cotton acreage per farm
	Number	Acres	Number	Acres
Southeast	16,020	82	3,265	181
Alabama	6,827	79	1,458	202
Georgia	4,279	87	770	171
North Carolina	2,405	60	620	111
South Carolina	2,509	102	417	229
Delta	34,228	123	10,921	214
Arkansas	7,585	147	2,019	201
Louisiana	4,486	130	2,371	237
Mississippi	11,277	150	3,710	264
Tennessee	8,119	61	1,850	131
Missouri	2,761	109	971	149
Southwest	33,918	152	19,839	253
Oklahoma	6,089	82	2,848	146
Texas	26,334	171	16,292	278
New Mexico	1,495	98	699	112
West	5,152	301	4,179	438
Arizona	1,143	351	1,177	441
California	4,009	287	3,002	437
United States 1/	89,536	137	38,266	256

1/ Totals include a small number of cotton producers and acreage in Florida, Illinois, Virginia, Nevada, and Kentucky.

Source: (31).

Table 7--Cotton acreage, production, and total farm sales, by size of farm, 1982

Cotton acres harvested	Farms	Acres of cotton	Bales produced	Farms by value of sales 1/: Less than $20,000	$20,000-$99,999	$100,000-$499,000	$500,000 or more
	Number	Thousand	Thousand	Number	Number	Number	Number
1-24	5,097	69	69	3,967	914	175	17
25-99	11,163	625	608	4,080	5,491	1,440	126
100-249	10,140	1,639	1,662	1,036	5,208	3,590	290
250 or more	11,866	7,450	9,037	151	3,571	6,066	2,060
All farms	38,266	9,781	11,376	9,234	15,184	11,271	2,493

1/ Includes total farm sales on farms reporting cotton harvest. Excludes 84 farms classified as institutional, experimental and research, and Indian reservations (categorized as "abnormal" in Census compilations).

Source: (34).

Tenure and Type of Organization

Share renting and cash renting of land for cotton production are common practices in all cotton production regions. Half of all farms harvesting cotton were operated by part owners while about 27 percent were operated by full owners and 23 percent by tenants (table 8). The proportion of full owners was highest in the West. Part owners were most prevalent in the Southeast and least prevalent in the West. The proportion of tenants was lowest in the Southeast.

Table 8--Tenure of farms harvesting cotton, by region and State, 1982

Region/ State	Full owners 1/	Part owners 2/	Tenants 3/	Total 4/
	Percent			Number
Southeast	26	61	13	3,247
Alabama	28	59	13	1,449
Georgia	25	61	14	767
North Carolina	21	63	16	617
South Carolina	27	64	9	414
Delta	27	51	22	10,904
Arkansas	19	49	32	2,015
Louisiana	30	51	19	2,364
Mississippi	30	52	18	3,707
Missouri	14	47	39	971
Tennessee	31	55	14	1,847
Southwest	27	48	25	19,778
Oklahoma	25	57	18	2,842
Texas	26	46	28	16,271
New Mexico	45	40	15	665
West	36	44	20	4,161
Arizona	38	38	24	1,164
California	35	46	19	2,997
United States	27	50	23	38,182

1/ Operate only land they own.
2/ Operate land they own and also land they rent from others.
3/ Operate only land they rent from others or work on shares with others.
4/ Excludes 84 abnormal farms.

Source: (34).

Full ownership becomes less prevalent as size of farm increases (table 9). But, the proportion of part owners increases with farm size, while the proportion of tenants varies less by size.

More than 80 percent of all farms that harvested cotton in 1982 were individual or family-held operations (table 10). The proportion of individual or family operations in the West was well below the national average. The corporate form of organization, although increasing, is undertaken by farm operators chiefly to take advantage of tax policies, limited liability, or property tax provisions. Cotton production has not attracted a substantial influx of capital investment by nonfarm corporations. Only 5 percent of all farms harvesting cotton were incorporated, ranging from 1 percent in Alabama and Tennessee to 19 percent in Arizona. Over 90 percent of these corporations were family held.

The proportion of individual or family operations decreased as the acres of cotton harvested per farm increased (table 9). As expected, partnerships and corporations gain in importance as size of farm increases, representing about 30 percent of farms harvesting 250 or more acres of cotton.

Table 9--Tenure and type of organization by acres of cotton harvested, 1982

Item	Farms by acres of cotton harvested 1/				
	1-24	25-99	100-249	250 or more	Total
	Percent				Number
Tenure:					
Full owners	53	31	21	18	10,439
Part owners	28	43	54	61	18,928
Tenants	19	26	25	21	8,815
Total	100	100	100	100	38,182
Type of organization:					
Individual or family	90	87	82	70	30,830
Partnership	8	10	12	18	4,974
Corporation	1	2	5	11	2,124
Family-held 2/	77	90	91	91	1,924
Other types	1	1	1	1	254
Total	100	100	100	100	38,182

1/ Excludes 84 abnormal farms
2/ Family-held corporations as a percentage of all incorporated farms.

Source: (34).

SIC Cotton Farms

About 21,000 farms--55 percent of all farms harvesting cotton--received 50 percent or more of their total farm sales from cotton lint and cottonseed in 1982 (table 11 and (34)). These farms are classified as cotton farms according to the Standard Industrial Classification (SIC) system used by the Bureau of the Census. SIC cotton farms harvested 331 acres of cotton per farm, compared with 256 acres per farm for all farms. They harvested three-fourths of the total U.S. cotton production in 1982, and their cotton sales averaged about $113,000 per farm. About half of these farms sold cotton and cottonseed valued at $40,000 or more. Sales of cotton accounted for about 76 percent of total agricultural sales from SIC cotton farms.

Table 10--Type of organization of farms harvesting cotton, by region and State, 1982

Region/ State	Individual or family	Partnership	Corporation	Total 1/
	Percent			Number
Southeast	79	17	4	3,247
Alabama	82	17	1	1,449
Georgia	77	18	5	767
North Carolina	77	15	8	617
South Carolina	76	18	5	414
Delta	80	14	6	10,904
Arkansas	75	15	10	2,015
Louisiana	85	11	4	2,364
Mississippi	76	15	9	3,707
Missouri	83	13	4	971
Tennessee	85	14	1	1,847
Southwest	87	10	3	19,778
New Mexico	81	13	6	665
Oklahoma	87	10	3	2,842
Texas	87	10	3	16,271
West	62	22	16	4,161
Arizona	60	21	19	1,164
California	62	23	15	2,997
United States	82	13	5	38,182

1/ Excludes 84 abnormal farms.

Source: (34).

The importance of cotton on these farms is further illustrated by census data on cropland use (table 11). Two-thirds of the harvested cropland was used for cotton, ranging from 76 percent on cotton farms in the Southwest to 53 percent in the Delta. Of the other crops, soybeans were most important, especially in the Southeast and Delta regions. Sorghum is an important alternative in Texas, while wheat is relatively important in Missouri, Oklahoma, Arizona, and California. Corn acreage was minimal on SIC cotton farms in 1982, and hay

Table 11--Use of harvested cropland on SIC cotton farms, by region and State, 1982 1/

Region/ State	Farms	Total harvested cropland	Share of total cropland in -- 2/				
			Cotton	Soybeans	Corn	Sorghum	Wheat
	Number	1,000 acres	Percent				
Southeast	1,426	665	57	30	4	1	9
Alabama	936	382	64	28	2	1	8
Georgia	200	99	54	24	3	*	11
North Carolina	103	41	50	35	9	--	7
South Carolina	187	144	45	41	8	--	11
Delta	6,844	3,340	53	39	*	1	8
Arkansas	878	444	49	41	*	1	12
Louisiana	1,899	782	63	30	*	2	5
Mississippi	2,692	1,655	50	43	*	1	7
Missouri	365	150	50	36	1	7	22
Tennessee	1,010	309	52	42	1	--	9
Southwest	10,134	4,627	76	1	1	13	8
New Mexico	275	52	66	--	1	9	4
Oklahoma	617	249	61	*	--	1	35
Texas	9,242	4,325	77	1	1	14	6
West	2,616	2,053	63	--	1	*	13
Arizona	927	591	72	--	*	13	13
California	1,689	1,462	60	--	1	--	13
United States	3/ 21,041	3/ 10,690	65	14	1	6	9

* = Less than 0.5 percent.
-- = No reports.
1/ Includes farms from which cotton and cottonseed sales account for 50 percent or more of the value of all agricultural products sold during the year. Excludes 32 abnormal farms.
2/ Cumulative percentage may exceed 100 percent because of double-cropping.
3/ Total includes a few cotton farms in States not listed above but excludes abnormal farms in all States.

Source: (34).

crops used only 3 percent of total cropland. Hay crops used 7 percent of the cropland in the West, ranging from 6 percent in Arizona to 14 percent in New Mexico.

The Production Process

Cotton plants require a common set of conditions for growth and fruiting, including the placement of seed in a medium favorable for germination and emergence, a sufficient level of soil moisture and plant nutrients for growth and fruiting, and a tolerable level of competing plants, insects, and disease organisms. These requirements determine crop production methods. 2/

Growth and Fruiting Characteristics

The growth of a cotton plant occurs in several stages, the timing of which depends on various cultural and environmental conditions. Although the timing of plant development varies somewhat by location, the sequence is roughly as follows (22):

1. Emergence of seedling -- occurs as early as 4 days after planting under favorable conditions (under unfavorable conditions, ranges up to 3 weeks). Planting starts as early as February in the lower Rio Grande Valley of Texas and as late as early June in the Texas-Oklahoma Plains regions.

2. Appearance of first floral bud (square) -- about 35-45 days after seedling emerges.

3. Floral bud to open bloom -- about 23-27 days. This stage is commonly referred to as the "squaring" period. The first bloom usually occurs in the first node of a fruiting branch low on the stalk. Shedding of squares is common due to internal and external stresses on the plant.

4. Appearance of successive blooms -- blooms usually appear in sequence from low branches to high branches on the plant, and from near to far from the stalk on the same fruiting branch. Blossoming usually continues throughout the growing season.

5. Open bloom to open boll -- boll development takes 40-80 days depending on temperature and other factors. Less than half of all blossoms commonly develop into mature bolls.

Cotton is a seed fiber that originates as an outgrowth of cells within the outer layer of the seedcoat of mature cotton seed. The fruiting form of the plant is the cotton boll, or the rounded capsule that contains the lint, fuzz, and seed. When the boll is ripe, it splits open and the fluffy mass expands beyond the walls or "burs" of the capsule. Each boll contains 3-5 "locks" of cotton, each of which contains several (usually 5-11) seeds per lock. The seeds of commercial varieties are densely covered with lint and fuzz. The harvested "locks," containing both seed and lint, make up what is known as "seed cotton."

2/ See (9) as an excellent reference on the biology of the cotton plant and production of the crop.

The cotton fiber consists of nearly 100-percent cellulose. The fiber originates in the wall of the seed, where it emerges from a single cell as a hollow tube. The growing tube is filled with protoplasm, and successive layers of cellulose are deposited as the fiber matures. The ultimate length of the fiber may exceed 3,000 times its diameter (17).

Basic Functions Performed

Tillage and seedbed preparation, planting, weed control, and harvesting are basic to the production process. Although these functions are universal, the methods used to perform them may vary among geographic regions because of differences in climate, soils, topography, or economic forces. The soil nutrients, soil moisture, and protection against pest organisms may be supplied in whole or in part by nature. Fertilization is necessary in most U.S. regions. Problems with insects and diseases affecting cotton vary greatly among regions, but most producers rely heavily on chemicals for control. Production is impossible without irrigation in some regions. Irrigation is also used in regions where nonirrigated production is possible but where substantial yield increases result from the use of supplemental water. Irrigated cotton acreage is very limited, although increasing, in the Delta Region and the Southeast.

Sequence of Production Practices

Cotton growers employ a general set of production practices for cotton in all areas across the Cotton Belt. Cultural techniques vary on and among farms within and among production regions, reflecting differences in such factors as soil texture and structure, topography, climate, plant diseases, and insect and weed control problems.

Commercial cotton farmers commonly develop a specific sequence of production practices to accomplish necessary functions. The chronological sequence of the practices is as follows:

1. Residue disposal
2. Preplant tillage
3. Seedbed preparation, including
   a. Fertilization
   b. Application of a broadcast, soil-incorporated preplanting herbicide
4. Planting, including
   a. Application of fungicides
   b. Application of systemic insecticides
   c. Application of preemergence herbicides
5. Postemergence weed control, both chemical and mechanical
6. Insect control
7. Harvesting and hauling

Irrigation is an additional major production practice in the Texas High Plains, and a necessity in all cotton areas west of the High Plains. Supplemental irrigation is employed on a limited basis in the rain-grown areas of the Southeast and the Midsouth.

Overview of Production Practices

This section presents an overview of basic agronomic practices and a description of how these practices are combined in a production system. The emphasis is on the unique character of each phase of the production process.

Residue Disposal. The cotton plant, producing a dense woody stalk, presents a unique problem in residue disposal, usually achieved with a tractor-towed rotary or flail shredder. The rotary cutter shreds crop residues with horizontally rotating blades. The flail cutter provides shredding and pulverizing actions with vertically rotating knives attached to a rotor. Each is a "power-takeoff" tractor-driven implement with two-row, four-row, or six-row capacity. The shredded material is then incorporated into the soil to speed decay.

Stalk shredding and incorporating of the shredded material occur immediately after harvest in most areas. This practice increases machinery efficiency and effectiveness, and facilitates decay of the shredded material. Some acreage of cotton stalks are shredded in the Midsouth but not incorporated into the soil if limited seedbed preparation is used. In the nonirrigated coarse-textured soil areas of the High Plains, stalks are often left standing to control wind erosion. However, in these instances, stalk residues are not dense enough to present a tillage problem for the succeeding crop, and there are no resulting insect or disease problems.

The boll weevil problem emphasizes the urgent need for early destruction of cotton stalks in all areas east of the Texas High Plains. The destruction of cotton plants as early as possible before the first killing frost prevents weevil population buildup and reduces the overwintering population. The earlier the weevil population is deprived of its food supply, the more effective this measure becomes. Early stalk destruction, especially over communitywide or countywide areas, has greatly reduced the boll weevil problem, especially in the southern part of the Cotton Belt.

Early stalk destruction and burial of infested debris are important practices in pink bollworm control. The shredding operation also kills a high percentage of pink bollworms left in the field after harvest. The flail-type shredder is recommended over the horizontal rotary type for pink bollworm control. Plowing under crop residue as deeply as possible after the stalk destruction can also reduce the number of overwintering bollworms and tobacco budworms. In the western Cotton Belt, mandatory stalk disposal dates and residue plowup dates constitute the major cultural practice used in controlling pink bollworm infestations. The areas under Federal regulation for pink bollworm control include all cotton producing counties from the eastern border of Texas and Oklahoma to California, all counties in the Red River Valley areas in Louisiana and Arkansas, and the four northern-most counties in the West Delta area of Arkansas.

Preplant Tillage. Preplant tillage covers all tillage operations performed after stalk shredding and prior to seedbed preparation. The sequence begins with incorporation of the shredded cotton plant into the soil and most commonly terminates with incorporation of a preplanting herbicide.

Cotton producers east of the Rolling Plains of Texas and Oklahoma use one of two general preplanting tillage sequences, depending chiefly on soil type and planting technique. On sandy and loam soils, a disk harrow is commonly used to incorporate the shredded plant material from the previous crop. Subsoiling (breaking up compacted soil or hard pans to improve internal soil drainage) is common where soil conditions warrant. Some type of deep tillage is also a common practice. The practice usually includes two passes over the field with a chisel plow. Over 90 percent of the cropland receives a broadcast soil-incorporated herbicide that requires two disk harrowings or other tillage to integrate the herbicide into the soil.

Clay soils are handled differently. Preplanting tillage is accomplished almost entirely with a disk harrow. On clay soils, three or four passes over the field are generally required to incorporate shredded plant material, to apply a broadcast soil-incorporated preplanting herbicide, and to prepare the soil for the seedbed preparation sequence.

Cotton producers in the Rolling Plains of Texas and Oklahoma and the High Plains areas in Texas and New Mexico grow cotton under dryland and irrigated environments. Preplant tillage for dryland cotton usually consists of three operations: tandem disking, chiseling, and listing. Each operation is performed on a once-over basis. On nonirrigated cotton land, tandem disking may be omitted if a preplant herbicide is not applied.

Preplanting practices for irrigated cotton generally consist of five tillage operations in the following sequence: tandem disking, chiseling, offset or tandem disking, land leveling with a landplane (only in the Far West), and tandem disking to incorporate a broadcast preplant herbicide. Each operation in the sequence is performed on a once-over basis, except land planing, which is usually a twice-over operation. Plowing the land with a moldboard plow is also a widely used tillage operation in irrigated cotton production, but it is typically done every 2-5 years.

The preplanting practices followed by cotton growers in irrigated areas of Arizona and California require the following implements: landplane, moldboard or chisel plow, disk harrow, subsoiler, broadcast herbicide applicator, and dry or liquid fertilizer applicators. Herbicide and fertilizer application may be done on a custom basis. The sequence and timing of operations may vary considerably on individual farms as well as among farms and production areas. In the sequence of operations, the landplane is used only if land leveling is necessary. Approximately 90 percent of all growers broadcast a soil-incorporated herbicide on cotton fields prior to planting.

Seedbed Preparation. Seedbed preparation encompasses those cultural practices between preplant tillage and planting. This set of agronomic practices prepares a warm, moist, well-formed, well-drained, clean, and firm seedbed. Rainfall and topography are the principal factors influencing seedbed preparation techniques.

Where annual rainfall exceeds 25 inches, and in many areas with less than 25 inches of rainfall, the seedbed is prepared largely by forming beds or ridges. Six- or eight-row "hippers" are commonly used to form beds on both sandy loam and clay soils. In irrigated areas, the rows provide water furrows for preplanting irrigation. Some growers in Alabama, South Carolina, and Georgia still use a "flat seedbed" for planting. This practice requires one or two additional times over the field with a disk harrow after completing the preplanting tillage sequence.

Prior to planting, the bedded land is usually tilled to reduce grass and weed infestations and to modify the bed profile for effective use of preemergence and postemergence herbicides. This operation may be performed with a soil pulverizer, cultivator, bed knifer, or a springtooth or drag harrow.

Growers in the low rainfall areas of the Cotton Belt also prepare a ridge-type seedbed. However, nonirrigated cotton is often planted in the furrow rather than on the bed or ridge. Thus, the beds trap any rainfall during the growing season, aid in the efficient use of supplemental irrigation water, and protect the emerging and seedling plants from wind damage.

Seedbed practices associated with cotton production on irrigated land are similar to those found in areas with adequate rainfall. The land receives a heavy preplanting irrigation after bedding and prior to "working" the beds before planting. Cotton is commonly planted on the bed with a water furrow remaining for row irrigation.

Fertilization. Fertilizer is a key production input for most cotton areas. However, the application rate, nutrient mix, and practices used to apply fertilizer may vary among farms as well as among areas.

Cotton producers generally apply all or most of the nitrogen, phosphate, potash, and other plant nutrients required by the crop during the seedbed preparation sequence. Fertilizers are also applied during the preplanting tillage operations in some areas. These nutrients may be applied in the row or broadcast. The application technique depends on the type of soil and farmer preference. Common nitrogen sources are anhydrous ammonia, liquid nitrogen solutions, and solid "prilled" (uniform size, coated) materials. Solutions and solid nitrogen sources may also carry considerable levels of phosphate and potash in some areas. Other plant nutrients are added as liquids or as prilled solid materials that usually contain low to moderate levels of nitrogen.

Most Southeast growers broadcast a mixed fertilizer in a granular form before planting. Although nitrogen sidedressing is still a common practice, many growers apply all nitrogen before planting. The amount of nutrients applied per acre varies from one area to another depending on soil type and past cropping patterns. A common practice in the Southeast is to apply 70-90 pounds of nitrogen (N), 60-80 pounds of phosphate (P_2O_5), and 90-120 pounds of potash (K_2O). Some farmers use less nitrogen to reduce plant growth and hasten crop maturity, especially in the northern part of the region where cool, wet weather near the end of the growing season frequently delays crop maturity.

Testing soil to determine fertilizer requirements for specific cotton fields is a common practice. Up to 50 percent of the preplanting fertilizer is applied by custom service in some areas of the Southeast. Lime is applied every 2 or 3 years on some cotton farms, usually as a custom operation.

In the Mississippi Delta, nitrogen fertilizer is usually applied as anhydrous ammonia during the bedding operation. If weather conditions do not permit preplanting applications, the nitrogen is applied as a sidedressing after emergence of the cotton. Very few farmers use split applications.

On sandy soils, application rates range from 60-90 pounds of nitrogen per acre as anhydrous ammonia. Anhydrous ammonia use has declined somewhat in recent years because heavier nitrogen applications may delay cotton maturity and create problems at harvest. Application rates on heavy soils typically range from 100-120 pounds of ammonium nitrate per acre. Use of liquid nitrogen is increasing on both sandy and clay soils. Application rates for liquid fertilizer generally range from 100-120 pounds of nitrogen per acre, usually applied in split application, part preplanting and part side dressed. Although a more expensive source of nitrogen, farmers are gradually changing to the liquid form because of its convenience and the problems encountered in sealing anhydrous ammonia in the heavy soils.

Lime, phosphate, and potash are occasionally used in the Mississippi Delta. However, some soils are beginning to need potash. In these cases, the application rate is about 60 pounds of potash per acre.

In the Arkansas portion of the Delta, anhydrous ammonia is used mostly on very large cotton farms. Preplanting applications are made if possible. Although liquid fertilizer on cotton is increasingly used, solid fertilizer is more common in this area. Application rates range from 50-70 pounds of nitrogen in the Arkansas Delta, and from 60-80 pounds in the Louisiana Delta. Split applications are common in these areas. Arkansas Delta farmers usually apply about 25 pounds of phosphate and 25 pounds of potash per acre in addition to the nitrogen.

Cotton in the Southern Brown Loam area of Mississippi is produced largely on the bottom lands adjoining the rivers and streams cutting across the area. The bottom lands are fertile and produce relatively high yields with proper fertilization, usually 30 pounds of nitrogen and 30-60 pounds each of phosphate and potash prior to planting. When the full amount of nitrogen is not applied before planting, the remainder is applied as a sidedressing after emergence.

In the Texas High Plains and Texas-Oklahoma Rolling Plains, fertilizer use in cotton production is limited to the irrigated land in most years. Irrigated cotton in the High Plains receives 40-70 pounds of nitrogen per acre as anhydrous ammonia. The rate varies with soil texture, amount of irrigation water used, and length of growing season. Most irrigated cotton also receives 20-50 pounds of phosphate per acre in the form of superphosphate. Fertilizer rates for irrigated cotton in the Rolling Plains range from 20-80 pounds of nitrogen per acre applied as anhydrous ammonia plus 20-60 pounds of phosphate per acre. Preplant application is the usual practice in both areas. The dry fertilizer is commonly broadcast on the land with spreader trucks.

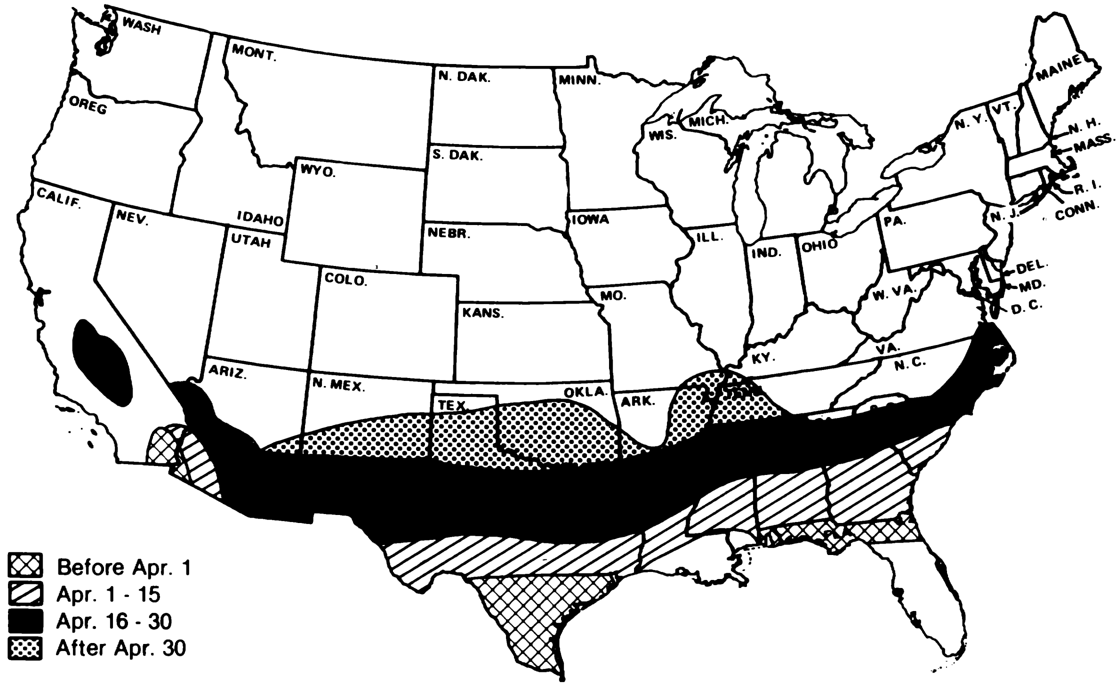
In California's Imperial Valley, fertilizer use consists almost entirely of nitrogen applied in split applications as anhydrous ammonia. The rates range from 200-240 pounds of nitrogen per acre on cotton, and even to 300 pounds in some cases. The highest rates are used in Imperial and Riverside Counties, CA. Fertilizer practices in Yuma County, AZ, involve lower rates of nitrogen, higher rates of phosphate, and the use of more dry fertilizer. Fertilizer is mostly custom applied in this area.

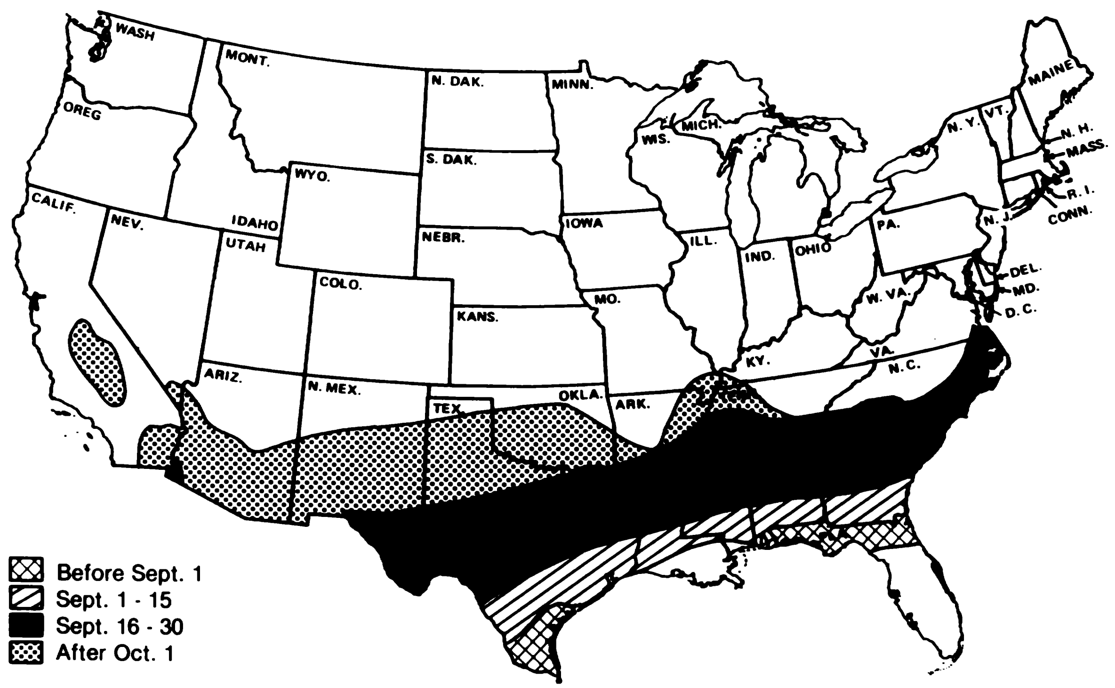
In the central Arizona area, nitrogen is the only nutrient commonly used, usually 150-200 pounds of nitrogen per acre in two applications in the form of anhydrous ammonia. Preplanting nitrogen is occasionally applied in irrigation water. Nitrogen is distributed through drip irrigation systems on a small but growing acreage in both Arizona and California. Some growers use small quantities of phosphate every third year. Little, if any, potash is applied to cotton in the area.

Fertilizer practices in the San Joaquin Valley are similar to those in other areas of the West. Nitrogen in the form of anhydrous ammonia, the principal fertilizer, is usually applied in split applications. Moderate rates ranging from 75-100 pounds of nitrogen per acre are applied to cotton on the relatively coarse soils of the central and east side of the valley. Heavier rates, ranging from 125-175 pounds per acre, are used on the fine-textured soils of the west side. The nitrogen is applied in two applications: a light

Figure 5

U.S. Cotton: Usual start of planting and harvesting, principal areas





Source: U.S. Department of Agriculture, Statistical Reporting Service. "Usual Planting and Harvesting Dates for U.S. Field Crops." AH-628.

preplanting application followed by a heavier application as a sidedressing during cultivation. Some growers use small amounts of zinc, phosphate, and potassium.

Planting. The set of practices used in planting varies as much among farms in an area as among areas, a condition reflecting differences in soils, climate, drainage, and weed problems. Growers generally delay planting until the soil temperature reaches 60° Fahrenheit at planting depth. Farmers in the Rio Grande Valley of Texas are first to plant cotton (February) and those in the High Plains are usually last (as late as June if replanting occurs). Most cotton planting across the Cotton Belt occurs in April (fig. 5). However, northern cotton areas usually delay most planting until May.

Planting frequently incorporates several cultural practices into a single operation. The basic operation consists of placing seed into the seedbed at the proper depth, covering the seed with soil, and pressing the soil over the seed. Proper seed depth is vital to a good stand. In low rainfall and irrigated areas, seeds are commonly placed in the soil at a depth of 1-1/2 to 2 inches. In the rainfed areas, seed is placed at depths of about 1 inch in sandy and loam soils, and 1-1/2 to 3 inches in clay soils. Common secondary operations associated with seed placement include the application of fungicides and systemic insecticides along with the seed to deter soilborne seedling diseases and to control aphids and thrips on seedling cotton.

Final seedbed preparation is an integral part of planting. The physical operation of placing cotton seed in the seedbed may be accomplished with one of two planting devices: a "double disk" opener planter or "runner or sword" opener planter. The double disk opener, widely used by commercial farmers, permits high-speed planting, is effective on a wide variety of soils and soil moisture conditions, and can be used to plant a number of other crops.

A cotton producer's objective is to "plant to a stand." Some growers attempt to achieve this goal by hill-dropping three to five seeds 12-14 inches apart in rows 38-42 inches wide, although a large variety of row spacings is used, including broadcast, skip-row patterns, and double-row spacings. A uniformly spaced stand of plants is desirable for chemical weed control in the production sequence, for maximum yields under a given production regime, and to reduce seed cotton losses associated with mechanical harvesting.

Irrigation. Irrigation has become a more important input as cotton acreage has shifted westward in response to higher yields, lower unit costs, and less risk. Land on which cotton is grown in the West (California and Arizona) could not be profitably used to grow cotton or any other field crops without irrigation. Rainfall in these areas is normally 5-12 inches per year and highly variable. Most of the cropland in the Southwest is used for cotton production without irrigation, but yields are enhanced greatly in some areas of west Texas where one or more irrigations are economically feasible. Normal rainfall is sufficient to provide the required moisture for crop maturation generally east of longitude 100° West, whereas west of that most of the crop is irrigated (12). The economic feasibility of irrigating cotton in the rain belt remains to be established due to erratic yield response and delay of crop maturity. With the exception of very dry growing seasons, average yield responses tend to barely recover all irrigation costs with the very low cotton prices of the mid-1980's.

Extent of irrigation: About 35 percent of the U.S. cotton acreage was irrigated in 1982, compared with about 37 percent in 1978 and 30 percent in 1974 (table 12 and (34)). All cotton in California, Arizona, Nevada, and New Mexico is irrigated at least once, including preplanting irrigation. Supplemental irrigation is practiced in Texas and Oklahoma and, to a more limited extent, in the Midsouth. In 1982, about 26 percent of the Southwest acreage was irrigated, compared with less than 9 percent in the Delta and 4 percent in the Southeast.

In 1982, nearly 40 percent of all irrigated cotton acreage was produced on farms harvesting 1,000 or more acres of cotton (table 13). Farms that harvested 250 or more acres accounted for about 80 percent of irrigated cotton acreage. Irrigated farms in the West tend to be larger than average, and substantial acreages are often required for profitable investments, especially for sprinkler systems.

Table 12--Farms harvesting cotton and acreage harvested: All cotton and irrigated cotton, by region and State, 1982

Region/State	All cotton		Irrigated cotton	
	Farms	Harvested area	Farms	Harvested area
	Number	1,000 acres	Number	1,000 acres
Southeast	3,265	590	174	23
Alabama	1,458	295	29	2
Georgia	770	131	123	19
North Carolina	620	69	5	1/
South Carolina	417	95	17	2
Delta	10,921	2,333	978	199
Arkansas	2,019	405	352	73
Louisiana	2,371	563	322	56
Mississippi	3,710	978	219	60
Missouri	971	145	79	9
Tennessee	1,850	242	6	1
Southwest	19,809	5,015	6,319	1,369
New Mexico	669	78	669	78
Oklahoma	2,848	414	441	58
Texas	16,292	4,523	5,209	1,233
West	4,179	1,831	4,179	1,831
Arizona	1,177	518	1,177	518
California	3,002	1,313	3,002	1,313
United States	38,266	9,781	11,658	3,423

1/ Fewer than 500 acres.

Source: (34).

Source and costs of water: About half of the irrigation water used on farms on which cotton is the largest irrigated crop is from onfarm wells, while most of the remainder is from off-farm suppliers (table 14). Census statistics for

Table 13--Farms harvesting cotton and acreage harvested: All cotton and irrigated cotton, by size of farm, 1982

Acres of cotton harvested per farm	All cotton		Irrigated cotton	
	Farms	Harvested area	Farms	Harvested area
	Number	1,000 acres	Number	1,000 acres
1-14	2,651	22	565	5
15-24	2,446	46	485	9
25-49	4,716	168	1,041	36
50-99	6,447	457	1,678	113
100-249	10,140	1,639	3,161	460
250-499	6,613	2,299	2,397	686
500-999	3,842	2,576	1,597	825
1,000 or more	1,411	2,574	734	1,288
Total	38,266	9,781	11,658	3,423

Source: (34).

Table 14--Sources of irrigation water on farms where cotton is the largest irrigated crop, 1979

State	Acre-feet obtained from --		
	Onfarm wells	Onfarm surface source	Off-farm supplier
		Percent	
Arizona	46.7	1.2	52.1
Arkansas	97.4	2.6	--
California	30.8	.5	68.7
Louisiana	77.8	12.4	9.8
New Mexico	76.5	--	23.5
Oklahoma	52.2	2.1	45.7
Texas	84.9	3.2	11.9
All States 1/	49.3	1.4	49.3

-- = No reports.
1/ Includes above States plus farms reporting irrigated cotton in other States.

Source: (33).

these selected cotton farms are probably more representative of all cotton farms than are State-average data, which are also available from the 1979 Farm and Ranch Irrigation Survey (33). Well water is the dominant source of irrigation water in the Southeast, Delta, and Southwest, while purchased water is the most important source in terms of acre-feet of use in California and Arizona. Off-farm supplies include the U.S. Bureau of Reclamation; irrigation districts; mutual, private, cooperative, or neighborhood ditches; commercial companies; and community water systems.

Irrigation costs vary greatly among areas, depending on many factors, including quantity of water applied, source of water, pumping lift, type of energy, and types of distribution system. Some estimated irrigation costs per acre of cotton irrigated are shown in table 15. The highest irrigation costs were in Arizona, where cotton generally receives about 5 acre-feet of water, compared with 3.5 to 4 acre-feet of water applied in California. Also, the pumping lift in Arizona averages about 400 feet, compared with about 200 feet in California (12). Pumping costs alone may average nearly $100 per acre irrigated in Arizona, compared with $25-$30 per acre in California. Water from surface sources, especially that from publicly subsidized projects, is generally less expensive than from ground water sources (39). About 50 percent of the California cotton acreage in 1981 and about one-fourth of the Arizona and New Mexico cotton acreage were served by U.S. Bureau of Reclamation (USBR) projects. Nearly 80 percent of the water provided by USBR costs farmers $15 or less per acre-foot, which is considered relatively inexpensive (39). Private irrigation districts that distribute water add a pumping charge for any water that must be raised to higher elevations to serve irrigators not on the main canal.

In the Texas High Plains, where rainfall is greater than in the West and occurs mainly during the relatively short summer growing season, cotton under "full irrigation" receives 1 to 1-1/2 acre-feet. Much of the High Plains cotton is under "partial" irrigation, which may involve a preplanting irrigation only, and usually receives only 5-8 acre-inches in a season. Water in the High Plains is expensive and increasingly limited as it is removed from a nonrechargeable aquifer.

Table 15--Representative irrigation costs per acre of cotton irrigated, 1984

State	Cost per acre irrigated 1/	Share of water from onfarm wells
	Dollars	Percent
Arizona	192	54
California	85	30
Oklahoma	62	53
Texas	64	85

1/ Includes all variable costs and equipment ownership costs.

Source: Unpublished ERS budgets used in estimating costs of production.

Water distribution methods: The most common method of applying water on cotton and other row crops is gravity flow (table 16). The gravity system involves running water down furrows by gravity flow. Water is typically delivered to the field from the pump or off-farm source through pipe or a head ditch. The water is released onto the field through a gated pipe or through siphon tubes or turnout panels from the head ditch.

While gravity flow irrigation predominates in the West, sprinkler irrigation is gaining in relative importance. Sprinkler systems were used on about 22 percent of the U.S. irrigated cotton acreage in 1979 (33). Sprinkler irrigation is the dominant method of irrigating cotton in the Southeast. Both sprinkler and gravity methods are common in the Southwest and Delta. Sprinkler systems, especially drip or trickle release systems, are technically more efficient than gravity methods in delivering water, but are usually more expensive where gravity systems are feasible. The shift toward sprinkler irrigation is hastened by higher costs and increasing relative scarcity of water. Automatic-move systems have rendered hand-move systems obsolete because of labor scarcity and cost, especially in field crop irrigation. The center-pivot system is used on most of the expanded irrigated acreage in the Southeast. This system better controls the amount of water applied per application, which is especially important in the rain belt where overwatering can be a problem. However, expansion of irrigation in the Southeast, as well as other regions, has likely diminished in the early 1980's due to low commodity prices and limited credit for such purchases.

Postemergence Weed Control. Postemergence weed control consists of some combination of mechanical cultivation and chemical herbicides. Producers in the rain belt rely much more heavily on postemergence herbicides. In areas

Table 16--Water distribution methods on farms where cotton is the largest irrigated crop, 1979 1/

State	Acres irrigated by --		
	Sprinkler system	Gravity system	Drip or subirrigation
		Percent	
Arizona	10.8	89.1	0.5
Arkansas	2.8	97.2	--
California	13.8	87.4	.3
Louisiana	55.1	44.9	--
New Mexico	31.7	68.7	--
Oklahoma	22.1	77.9	--
Texas	32.6	68.2	.1
All States	21.8	79.0	.2

-- = No reports.

1/ Total may exceed 100 percent as there may be some acreage on which 2 systems are used.

Source: (33).

where postemergence herbicides are not used, weed control is achieved primarily with mechanical cultivation and some hand hoeing. Herbicides are usually constrained to an area extending 8 inches from each side of the seedling plants. Shallow cultivation covers the area between the rows outside the area treated with chemicals. These two weed control practices are usually performed simultaneously. Some growers apply a single broadcast application of herbicide when the cotton plant reaches 15-24 inches in height. At that point the crop is "laid by," meaning that tillage ceases.

Weed control programs eliminate specific combinations of grass and broadleaf weeds within set time frames. Thus, the grower adapts a program to an individual situation that has been conditioned by previous cultural and herbicide inputs. A complete program generally requires three to four postemergence applications.

Growers outside of California who use postemergence herbicides generally use arsenicals in conjunction with mechanical cultivation to control grass in seedling and young cotton. Broadleaf weed infestations are controlled with urea-based herbicides and mechanical cultivation. If grass and broadleaf weeds occur together, growers often combine arsenicals and urea-based herbicides and apply the mixture in conjunction with mechanical cultivation. Growers in California depend almost exclusively on the urea-based herbicides to control both grass and broadleaf weeds. Specialized herbicides are available to control specific plant pests such as Johnson grass and nutsedge.

Postemergence herbicides are not typically used in the High Plains and Rolling Plains on either irrigated or nonirrigated cotton. In Arizona and California, the predominant use of postemergence herbicides is at "layby" time to prevent late season infestations of weeds prior to harvest.

Postemergence herbicide applicators have three basic components: (1) fiberglass or stainless steel tanks, normally front-mounted on the power unit, (2) a high pressure pump operating off the tractor power-takeoff, and (3) two or four spray nozzles per row attached to the frame of a mechanical cultivator.

Insect Control. A large number of insects are known to cause damage to cotton, but attacks from most of these insect pests are usually sporadic and local. Major problem insects in the Cotton Belt are cotton aphids, thrips, plant bugs, boll weevil, bollworm, pink bollworm, and tobacco budworm. Problems with insects are greatest in the Delta and Southeast and least in the High Plains where insect problems are limited primarily to early season thrips in some years. The Far West also has major insect pests, the most critical being the pink bollworm.

Growers gear insecticide applications to control a specific insect or a group of insects at a specific time. The decision to apply insecticides is usually based on both the economic benefits to be derived by controlling one or a group of insect pests and on the probability that insecticides applied at one time may create another pest problem at a later time. Most farmers attempt to maintain a field environment in which native predators and parasites provide biological control of most of the insect pests of cotton for as long as possible. Some growers employ specially trained personnel to check fields for insect problems and recommend a course of action, sometimes a specific insecticide recommendation.

Early-season insecticide applications are commonly applied with tractor-mounted or high-clearance ground sprayers. Mid- and late-season applications are most often applied by custom aerial applicators.

Rainfall or level of irrigation and temperature play a major role in determining the kinds and magnitude of cotton insect problems. In areas subject to summer droughts or where the growing season is short, any insect injury causing delayed fruiting or loss of early fruiting buds can substantially reduce yield. The control of even a light infestation of injurious insects early in the season under these conditions may be important. Hot weather combined with moderate rainfall in early summer and through midsummer deters the rapid expansion of boll weevil, bollworm, and tobacco budworm populations.

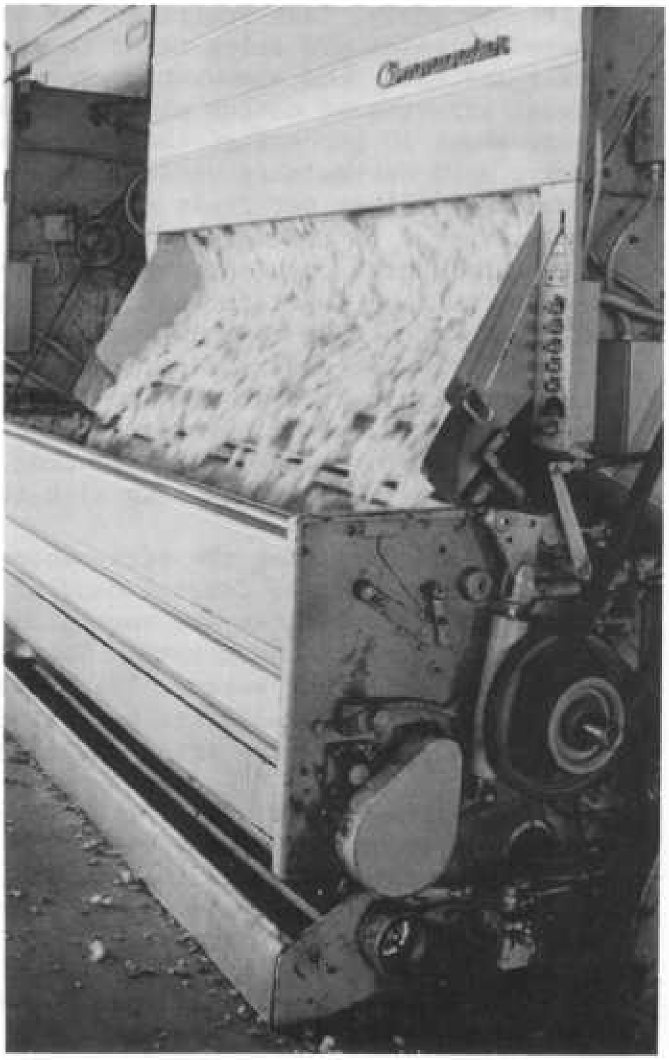
Harvesting and Hauling. Mechanical harvesting is the final phase of the cotton production process. Machine picking with spindle-type pickers is the predominant method of harvesting cotton in the United States, accounting for about three-fourths of the crop in recent years. Machine stripping is the predominant method in Texas and Oklahoma, accounting for more than 90 percent of their crops in some recent years. A third type of mechanical harvester is the gleaner or ground retriever, used to harvest about 1 percent of the U.S. crop.

The ownership and operating costs of the stripper harvester are lower than those of the spindle picker. Strippers can usually be operated faster than a picker and can handle more acreage per machine of a given size. Spindle pickers are better adapted to the tall plants and humid conditions of the Delta and Southeast regions and in the West. Strippers are used in areas such as the High Plains and the Rolling Plains where plant size is not excessive and the crop matures early and uniformly.

Cotton producers in the rainfed portion of the Cotton Belt east of the Rolling Plains of Texas and Oklahoma usually harvest with a spindle-type picker. Two-row, self-propelled machines predominate. Chemical defoliation of the cotton plant is initiated when about 60-70 percent of the bolls on the plant are open. Harvesting begins 10-14 days later. Approximately one-third of the crop is picked a second time. Seed cotton is transferred from the harvester to trailers or modules in the field and delivered to the gin, either by the grower or in some cases by the gins if modules are used.

Growers in the irrigated western areas of the Cotton Belt generally use two-row, self-propelled spindle pickers to harvest the crop. Four-row, self-propelled spindle pickers are now available and are used in the irrigated West as well as the Delta and Southeast. The harvesting sequence is similar to that for the rainfed areas using a spindle-type machine. Adverse weather seldom occurs in these irrigated areas during the harvest season, permitting farmers to harvest the crop rapidly and facilitating the storage of seed cotton in the field until the cotton can be moved to the gin. However, harvest in California must be completed before the winter fog and rainy season occurs.

In recent years, growers have stored more than one-third of the harvested seed cotton in modules in the field or at gins. Module cotton is formed by tightly compressing stacks (modules) of cotton on the ground or on a pallet resting on the ground. The cotton module is hauled to the gin in a palletless module mover truck or a trailer transporter.



Mechanical pickers, such as those above in southern Texas, have allowed average harvested cotton acreage per farm to increase to 256 acres in 1982, up from 24 acres in 1949. (USDA photo)

Gins, such as those at right in Texas, remove cotton fiber from the seed before the cotton is baled for storage or transportation to textile mills. Gins are usually located close to cotton farms. (USDA photo)

The harvesting sequence for cotton producers using mechanical strippers in the Southwest typically begins with natural defoliation or desiccation from a killing freeze. Little chemical defoliation occurs in most years. The mechanical stripping operation begins 10-20 days later. Stripping is a once-over operation. The machine strips all open and unopen bolls, small limbs, and some leaf trash from the cotton stalks. This material is transferred from the harvester to trailers in the field or stored in the field with the use of modules.

Custom picking is available on a limited basis throughout the Cotton Belt. Custom rates are normally based on pounds of lint but in some areas on pounds of seed cotton, with a considerable price differential between first and second pickings. Custom operators typically provide the mechanical harvesters, trailers or modules, and the associated labor and deliver the seed cotton in trailers to the gin. If modules are used, the custom operator commonly delivers the seed cotton to storage sites in the field and the grower or gin transports the seed cotton from field storage to the gin.

New Cotton Production Systems

Cotton geneticists and breeders have devoted considerable research to developing earlier fruiting and maturing cotton throughout most of the Cotton Belt. An early, fast-fruiting type of cotton has been developed in Texas. These varieties are being tried in many of the cotton-producing regions of Texas and have been somewhat successful in three subregions. Although the actual acreages of cotton planted to new varieties vary somewhat from year to year, about 10 percent of the Rio Grande Valley crop is now planted to the early, more determinate varieties of cotton. These varieties have certain advantages: they set fruit earlier, mature more rapidly, and are ready to harvest prior to the more conventional cotton. These advantages allow the use of fewer inputs, particularly fertilizer, water, and insecticides. However, results to date indicate that these cottons, in general, do not produce yields as high as the more conventional varieties in most years. Reduced expenditures for water, fertilizer, and insecticides do, however, result in a considerably lower cost of production which, at least for some farmers, is very desirable even if yields are reduced. Farmers who use the early maturing varieties feel that they are reducing risk somewhat and their income is equal to or greater than it had been with the more conventional varieties.

Another area utilizing the early maturing varieties on about 90 percent of its cotton acreage is the Coastal Bend of Texas where the principal reasons for producing the varieties are lower insect control costs due to a shorter growing season and lower risk. These early maturing cottons allow harvesting before the hurricane season. With the more conventional varieties of cotton, which are normally ready for harvest at a considerably later date, hurricanes can severely damage the crop, reducing yield and income.

About 80-90 percent of the cotton acreage in the Rolling Plains of Texas is planted to early maturing varieties. Production practices are basically unchanged except for insect control. Farmers can delay planting so that overwintering boll weevils die of starvation when they emerge. Entomologists refer to this planting system as forcing suicidal emergence of the boll weevil. This delayed planting significantly reduces insect control costs, and yield is affected very little compared with conventional varieties.

The early season cottons seem to work very well in certain regions of Texas where, even though most of the cotton is grown without irrigation, rainfall is fairly limited. Trials in States east of Texas have not found these early season cottons to be desirable. In the higher rainfall portions of the Belt, cotton is not nearly as determinate and yields are significantly lower than for the more conventional maturing varieties. These lower yields result in significantly lower returns to the grower even though costs may be reduced somewhat.

Modified production practices in southern Georgia show promise in increasing yields and income. One of the more basic problems associated with cotton production in southern Georgia has been a very large plant size which results in slow and poor fruiting and erratic yields under certain weather conditions. The modified southern Georgia production system encourages the use of earlier fruiting cottons which have been developed by cotton breeders, but this cotton is not significantly more determinate than standard varieties. It simply fruits a little earlier, allowing harvesting a few days earlier. The key to the new southern Georgia system is significantly reduced nitrogen fertilizer and much closer attention to controlling insects during the early part of the growing season. Only 30-60 pounds of nitrogen are used with this system, reducing costs and plant height. Petiole (leaf stalk) sampling during the growing season determines the need for additional nitrogen by the plant. If added nitrogen is needed, foliar nitrogen is applied, usually by air, at a low rate of about 5 pounds per acre. This procedure significantly reduces plant height and increases total fruiting and, thus, yield. Irrigated cotton in southern Georgia represents a small percentage of the total cotton acreage but is increasing rapidly. Irrigation is proving to be very effective in increasing yields in dry years on sandier soils. Most of the increased irrigation is done with center pivot systems.

Several products of research and development show promise under certain conditions, including conservation tillage, boll weevil eradication and other area-wide insect management programs, and plant growth regulators. New management systems may be developed as a result of a pilot computer communications network and a new cotton crop simulation model. The computer communications network is being tested across the Cotton Belt to assess interest within the cotton industry in communicating via computer with USDA offices and other information sources. The cotton crop simulation model, GOSSYM-COMAX, is a computer-aided system designed to aid farmers in making onfarm management decisions on irrigation, fertilization, defoliation, and other production inputs and practices.

Costs of Production

Costs of producing cotton have risen sharply since the mid-1970's. Cash receipts have not kept pace with rising costs, resulting in low or negative net returns since 1978. This situation is of particular concern to the cotton industry in view of the competition from foreign cotton producers and from manmade fibers. This section presents regional average production costs and cash receipts from marketings during 1978-85.

Costs per acre and per pound of lint have varied substantially within and among regions since 1978 (table 17 and app. tables 1-5). Cash costs averaged 57 cents per pound in the United States during 1982-85, ranging from about 51 cents in the Delta to 64 cents in the West. During 1978-81, the Southeast experienced the highest cash and economic costs per pound among the four regions, but unit costs were nearer the U.S. average level in 1982-85 because of improved yield.

Cash receipts from lint and seed have covered cash expenses and machinery and equipment replacement in all regions and years since 1978 except for the Southwest in 1980, 1981, 1982, and 1984, and the Southeast in 1980, 1981, and 1983. The low returns in both regions in 1981 were chiefly caused by low prices received for lint, while low yields resulted in high unit costs in the other years cited above. Cash receipts do not include Government payments, which have been an important part of total income from cotton since 1981. Cash receipts fell short of covering U.S. average economic costs in all but 1 year since 1978. When direct Government payments are included as income, the resulting returns above economic costs (returns to management and risk) were improved, but returns were negative during 1978, 1980, 1981, and 1982.

The 1982-85 U.S. average return to management and risk (returns above economic costs) was lower than in 1978-81, as higher costs in 1982-85 more than offset the higher average yields. This measure indicates an unfavorable longrun financial position for the average U.S. producer unless costs are reduced or prices improve. Although other estimating procedures and assumptions could be used, economic costs may be used to indicate the break-even longer run average price necessary for continued production. However, no single cost estimate is useful for all purposes.

Returns to management and risk were positive in the Southwest in only 1 year during 1978-85 (app. tables 1-5) and in only 2 years in the Southeast. In contrast, returns were positive in the Delta and the West in 4 of the 8 years.

The above costs and returns estimates allow comparisons of the shortrun and longrun financial situations among regions and crops (13). The USDA costs and returns measures are separated into three major categories: cash receipts, cash expenses, and economic (ownership or opportunity) costs. The shortrun cash-flow contribution of an enterprise is determined by subtracting cash expenses from cash receipts. The economic cost estimates suggest the longer run relative profitability of an enterprise through two additional estimates of returns: (1) Residual returns to management and risk and (2) net returns to owned inputs. The costs (or allocated returns) of some items, including returns to operating capital, nonland capital, land rent, and unpaid labor, are imputed because they cannot be measured directly (26).

Sector Costs and Returns

Cotton production sector returns above cash expenses were relatively high from 1975 through 1980, averaging about 29 cents per pound of lint, or about $140 per bale (table 18). This return represents the amount remaining for payment of family living expenses and fixed expenses of land, capital replacement, and debt retirement. Prices received for lint rose from 51.1 cents per pound in 1975 to a peak of 74.4 cents in 1980, keeping pace with the rising costs of production during the period. Even with higher deficiency payments to participating producers, total and per pound net returns dropped substantially in 1981 and 1982 as prices dropped below 60 cents per pound, reducing cash flow for producers. The 1983 net return per pound produced was relatively high, both in nominal and real terms, chiefly because of the payment-in-kind (PIK) program and the large deficiency payments. The record-high yield of 1984, combined with lower mill use and exports in 1984/85, resulted in lower prices and net returns for the 1984 crop. Yields in 1985 were again

Table 17--U.S. and regional cotton production costs and receipts per pound of lint

Item	1982	1983	1984	1985	Average 1982-85	Average 1978-81
	Dollars per pound					
United States:						
Cash expenses	0.566	0.638	0.560	0.518	0.570	0.518
Cash expenses with replacement 1/	.643	.733	.642	.593	.653	.612
Economic costs 2/	.728	.841	.729	.675	.743	.757
Cash receipts, lint	.580	.664	.575	.555	.594	.626
Cash receipts, seed	.064	.138	.084	.054	.085	.094
Delta:						
Cash expenses	.483	.581	.491	.488	.511	.526
Cash expenses with replacement 1/	.554	.681	.570	.567	.593	.632
Economic costs 2/	.597	.772	.629	.621	.655	.786
Cash receipts, lint	.582	.664	.548	.543	.584	.638
Cash receipts, seed	.050	.129	.064	.041	.071	.092
Southeast:						
Cash expenses	.508	.875	.493	.476	.588	.644
Cash expenses with replacement 1/	.579	1.010	.571	.554	.678	.765
Economic costs 2/	.618	1.059	.642	.619	.734	.905
Cash receipts, lint	.579	.674	.579	.547	.595	.651
Cash receipts, seed	.048	.132	.070	.042	.073	.082
Southwest:						
Cash expenses	.604	.588	.532	.487	.553	.505
Cash expenses with replacement 1/	.712	.701	.635	.578	.656	.608
Economic costs 2/	.856	.871	.780	.721	.807	.760
Cash receipts, lint	.514	.601	.525	.534	.544	.566
Cash receipts, seed	.070	.144	.091	.054	.090	.093
West:						
Cash expenses	.628	.693	.674	.586	.645	.529
Cash expenses with replacement 1/	.690	.763	.739	.641	.708	.601
Economic costs 2/	.779	.830	.799	.689	.774	.739
Cash receipts, lint	.625	.722	.650	.588	.646	.673
Cash receipts, seed	.075	.139	.100	.067	.095	.097

1/ Cash expenses plus an allowance for the replacement of machinery and equipment.
2/ The major differences between cash expenses and economic costs measurements relate to the way interest on capital investment is handled and the inclusion of land and labor costs. Cash expenses include all interest payments on real estate and nonland categories, while economic costs do not include cash interest payments. Economic costs include an imputed long-term average rate of return on production assets and an opportunity cost of annual operating capital based on the 6-month U.S. Treasury bill rate. Economic costs include land rent and both paid and unpaid labor. Hired labor is included in cash expenses.

Source: (13, 27).

record-high, exports dropped nearly 70 percent, prices also dropped, and net returns were relatively low irrespective of large deficiency payments. In real terms, the net returns per pound in 1981, 1982, 1984, and 1985 were much lower than during 1975-80.

Government payments in recent years have been a relatively small but important proportion of total producer income from cotton (table 18). From 1975 through 1980, disaster payments made up 2-6 percent of total income from cotton. Disaster payments were made to producers who either experienced abnormally low yields or were prevented from planting by poor weather or other natural causes.

Deficiency payments in 1981 and 1982 boosted the importance of Government direct payments to 11 percent and 15 percent, respectively, of total income from cotton. The value of PIK cotton entitlements in 1983 (about $1.1 billion) is included with direct payments for that year. Thus, Government payments were about 34 percent of total income from cotton in 1983. In 1985, the direct payment of $1,065 million made up about 22 percent of total income from cotton and about 66 percent of net returns.

Table 18--Cotton sector costs and returns

Crop year	Farm value 1/	Direct payments 2/	Total income	Total cash expenses 3/	Returns above cash expenses 4/: Total: Nominal	Total: Real	Per pound: Nominal	Per pound: Real
	Million dollars						Cents	
1975	2,335	118	2,453	1,616	837	656	21.1	16.5
1976	3,648	98	3,746	2,020	1,726	1,272	34.2	25.2
1977	3,956	69	4,025	2,611	1,414	977	20.6	14.2
1978	3,489	228	3,717	2,465	1,252	806	24.2	15.6
1979	5,041	108	5,149	3,003	2,146	1,270	30.8	18.2
1980	4,507	302	4,809	3,280	1,529	830	28.9	15.7
1981	4,587	550	5,137	4,121	1,016	502	13.6	6.7
1982	3,731	654	4,385	3,514	871	405	15.3	7.1
1983	2,942	1,528	4,470	2,360	2,110	945	57.3	25.7
1984	4,058	665	4,713	3,438	1,275	548	20.7	8.9
1985	3,937	1,065	5,002	3,245	1,757	731	27.6	11.5

1/ Production times average farm price, including both lint and seed. The value of cottonseed produced averaged about 14 percent of the total value of lint and seed, 1975-85.

2/ The sum of deficiency, diversion, and disaster payments to producers. 1983 also includes loan value of PIK (4.3 million bales @ $0.53 per lb.)

3/ Cash costs per planted acre times acreage planted; cost of maintaining conservation use acres (CUA) is $25 per acre times CUA.

4/ The difference between total income and total cash expenses; this difference was divided by the GNP implicit price deflator (1972 = 100) to derive real values.

Source: (13, 27, 30).

The demand for raw cotton fiber is derived from consumer demands for textile products. Textiles are found in apparel, household, and industrial products. Items as disparate as tire cord, conveyor belts, air filters, carpeting, towels, shoe linings, T-shirts, and upholstery are made from fibers.

Cotton is only one of many fibers used in textile products. Manmade fibers now account for about three-fourths of U.S. mill use, although cotton still accounts for about one-half of total fiber consumption worldwide. The major noncellulosic manmade fibers include polyester (about two-fifths of manmade fiber production) and nylon (about one-fourth of all manmade fiber production). Olefin and acrylic are less important noncellulosic manmade fibers. Rayon and acetate are cellulosic manmade fibers, and together account for about 5 percent of total manmade fiber production. Wool is the other major natural fiber but accounts for only about 3 percent of U.S. mill use. Flax and silk together account for only about 0.1 percent of U.S. mill use.

Demand Relationships

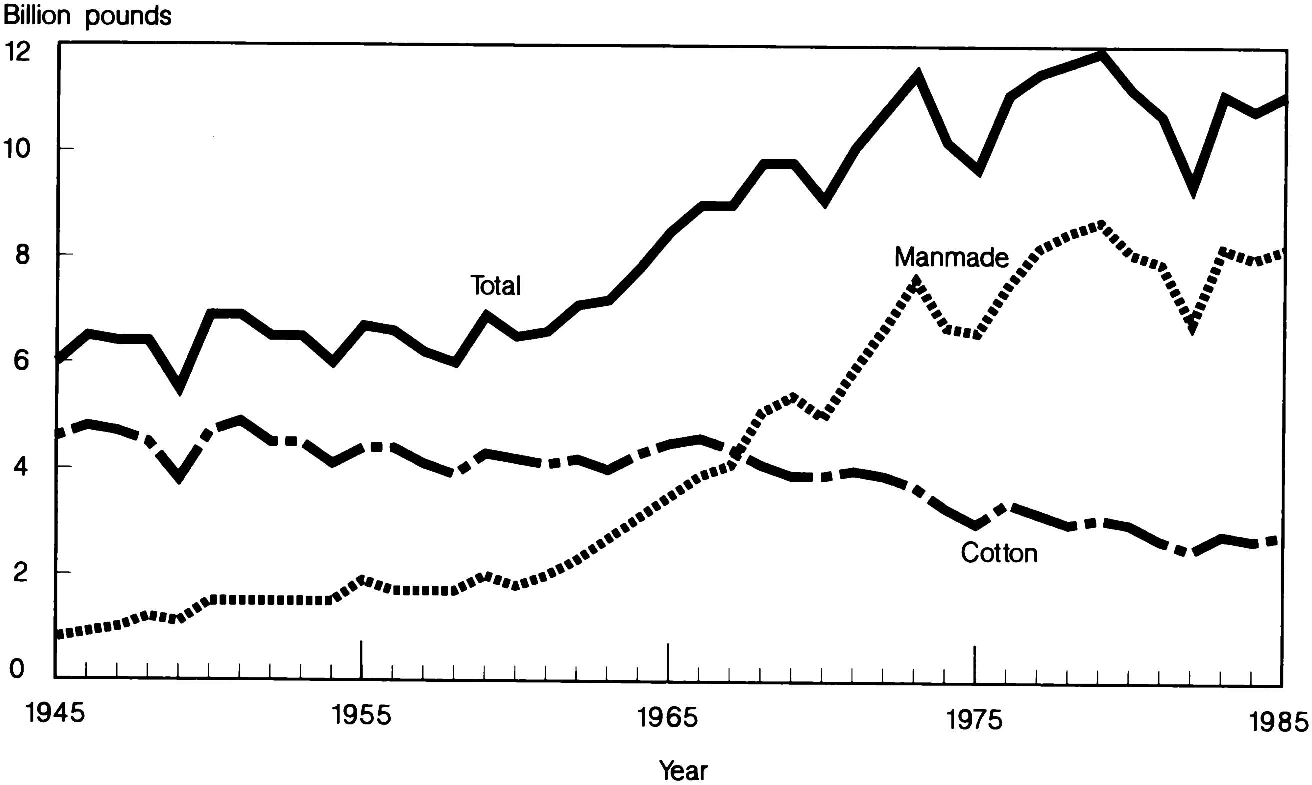
Major factors affecting U.S. mill use of cotton are competing fiber prices, consumer income, cycles in U.S. textile activity related to the U.S. business cycle, changing lifestyles, cotton price instability, fiber characteristics, and trade in textile products.

Even in the long run, total fiber demand is price inelastic, meaning that a 1-percent change in the price of raw fiber causes less than a 1-percent change in the quantity of fiber demanded. In apparel products, where fiber is the major primary material, the costs of spinning, weaving, finishing, cutting, sewing, packaging, storing, transporting, and retailing dwarf the cost of raw fiber. Consequently, a large change in the cost of fiber may have a negligible effect on consumer prices, and little discernible change in the total quantity of fiber demanded may result.

However, the demand for individual fibers may be less inelastic than the demand for all fibers together, although the elasticity of demand, even for individual fibers, is still less than 1. For example, shortrun elasticity of mill demand for cotton has been estimated to be about -0.2 to -0.35, meaning that a 10-percent increase in raw cotton price will generate a 2-3.5-percent drop in mill consumption of cotton.

Since World War II, cotton's share of U.S. mill use has fallen from about 80 percent to about 25 percent (fig. 6). Manmade fibers, particularly polyester and nylon, are now the major fibers in a large number of end uses previously dominated by cotton, but the cotton industry is beginning to regain some of these markets. Also, manmade fibers are best suited for many products invented since World War II, particularly industrial and household products, although cotton can substitute in some of these end uses as well. The resulting interfiber competition magnifies the quantity response from a particular fiber price change. Some textile machinery and machine settings are specific to the types of fiber being used, so textile mills may need up to 6 months or longer to convert from one fiber blend to another. Nevertheless, a perceived longrun change in relative fiber prices encourages mills to adjust their production accordingly.

Figure 6
U.S. mill use of fibers



Changes in fiber consumption are positively correlated with changes in consumer income. Estimates vary, but a 1-percent increase in income is generally expected to cause total fiber consumption to rise by more than 1 percent. As incomes rise, consumers can afford additional clothing and home furnishings, such as carpeting, drapery, and towels. Also, as consumers can afford more manufactured products, the demand for industrial textiles rises.

Most textile products are considered semidurable or durable goods, meaning that they have a useful life of more than 1 year. While air filters or shop rags may not fall into this category, most other textile products do. Therefore, consumers often treat the purchase of textile products as an investment. When incomes are rising and consumer confidence is high, consumers are willing to purchase products ranging from new suits to carpeting. Conversely, during economic downturns, consumers are apt to defer purchases of new clothes, home furnishings, and manufactured products.

Uses for cottonseed provide a secondary source of income for cotton producers. Cottonseed can be fed directly to dairy cattle or crushed to produce meal and oil. Seeds also yield linters (fuzzy little fibers) and hulls. Cottonseed usually provides about 12-15 percent of the total farm value of cotton production, with lint accounting for the rest of the value.

Cottonseed oil accounts for about 5 percent of the fats and oils used in edible oil products in the United States, with soybean oil, corn oil, and edible tallow being the major competing oils. Hulls and meal, as well as whole seeds, can be used as cattle feed supplements. Linters are used in paper, upholstery stuffing, dynamite, and other products where fiber strength is not important. Linters are also sometimes used as the cellulosic material in the production of rayon and acetate.

Domestic Fiber Consumption

Total U.S. fiber consumption (U.S. mill use plus textile imports on a raw fiber equivalent basis, minus the raw fiber equivalent of textile exports) rose from about 4.7 billion pounds during 1940 to about 12.5 billion pounds in 1978. Population growth, rapidly rising real incomes, changing lifestyles, the invention of new textile products, and decreases in real fiber prices explain much of the increase in fiber consumption. Per capita fiber consumption rose from about 34 pounds in 1949 to about 56 pounds in 1978. Both total and per capita fiber consumption fell during 1979-82 to 10.5 billion pounds and 45 pounds, but then recovered following the recession to about 13.5 billion pounds and 57 pounds in 1985.

Despite the increase in total fiber consumption, domestic consumption of cotton declined from a postwar peak of 10.4 million bales in 1966 to 6.5 million bales in 1982, before rebounding to 8.6 million bales in 1985. Per capita cotton consumption was 17.2 pounds in 1985 compared with 25.4 pounds in 1966. Loss of market share to polyester and nylon accounts for cotton's decline. Cotton accounted for 81 percent of total U.S. fiber consumption in 1940, 53 percent in 1966, and about 30 percent in 1985.

Domestic consumption of wool has also fallen since World War II. In 1948, over 700 million pounds of wool, 12.1 percent of domestic fiber consumption, were used in the United States. Wool consumption remained around 500 million pounds through much of the 1950's and 1960's but fell to 142 million pounds in 1974, about 1 percent of fiber consumption. Beginning in the late 1970's, consumers seemed to take renewed interest in wool. Wool consumption rose to 2.5 percent of domestic fiber consumption, about 341 million pounds in 1985.

Use of rayon and acetate peaked in the late 1960's at about 1.7 billion pounds, or about 9 pounds per person. By 1984, consumption of these fibers had fallen to about 2.4 pounds per person, 570 million pounds. In the early 1960's, rayon and acetate accounted for nearly 20 percent of total fiber use.

Increased consumption of noncellulosic fibers has accounted for almost all of the increase in domestic fiber consumption since World War II. From only 4 million pounds in 1940, noncellulosic consumption rose to about 8 billion pounds in 1979. This amount equalled about 35 pounds per person, and represented over 66 percent of total fiber consumption. Noncellulosic consumption fell during the 1980-82 recession, but rebounded to over 8 billion pounds again in 1985.

U.S. Mill Consumption of Cotton

U.S. mill consumption of cotton has been reduced both by competition with manmade fibers and by growth of the cotton textile trade deficit. Particularly after 1950, cotton lost market share to polyester and nylon because they are easier to care for, more durable, and easier to handle in textile mills. From 1970 to 1985, noncellulosics were cheaper (table 19). In most industrial and household products, and in many apparel products, manmade fibers have been able to dominate cotton.

In addition to being cheaper between 1970 and 1986, manmade fiber prices are more stable than cotton prices. Cotton production cannot be adjusted from month-to-month, and production uncertainty exists each year. Also, cotton is produced on 38,000 farms, while manmade fiber production is more concentrated among large chemical companies. Although price risk can be reduced through use of futures contracts, the inherent instability of cotton prices, combined with polyester's average price advantage, contributed to loss of market share for cotton.

Cotton's major advantages over manmade fibers are its breathability and absorbency. These characteristics have enabled cotton to remain dominant in some uses like denim, underwear, and toweling. Those "comfort" advantages, combined with cheaper prices in the 1980's, are leading to a rebound in U.S. cotton use (fig. 7). Cotton mill use dropped as low as 5.3 million bales in 1981/82, but rose to about 6.3 million bales in 1985/86. With lower prices allowable beginning in 1986/87 under the new cotton program, mill use may climb toward 7 million bales during the late 1980's.

Table 19--Annual average fiber prices at Group B mills and cotton's share of U.S. mill use 1/

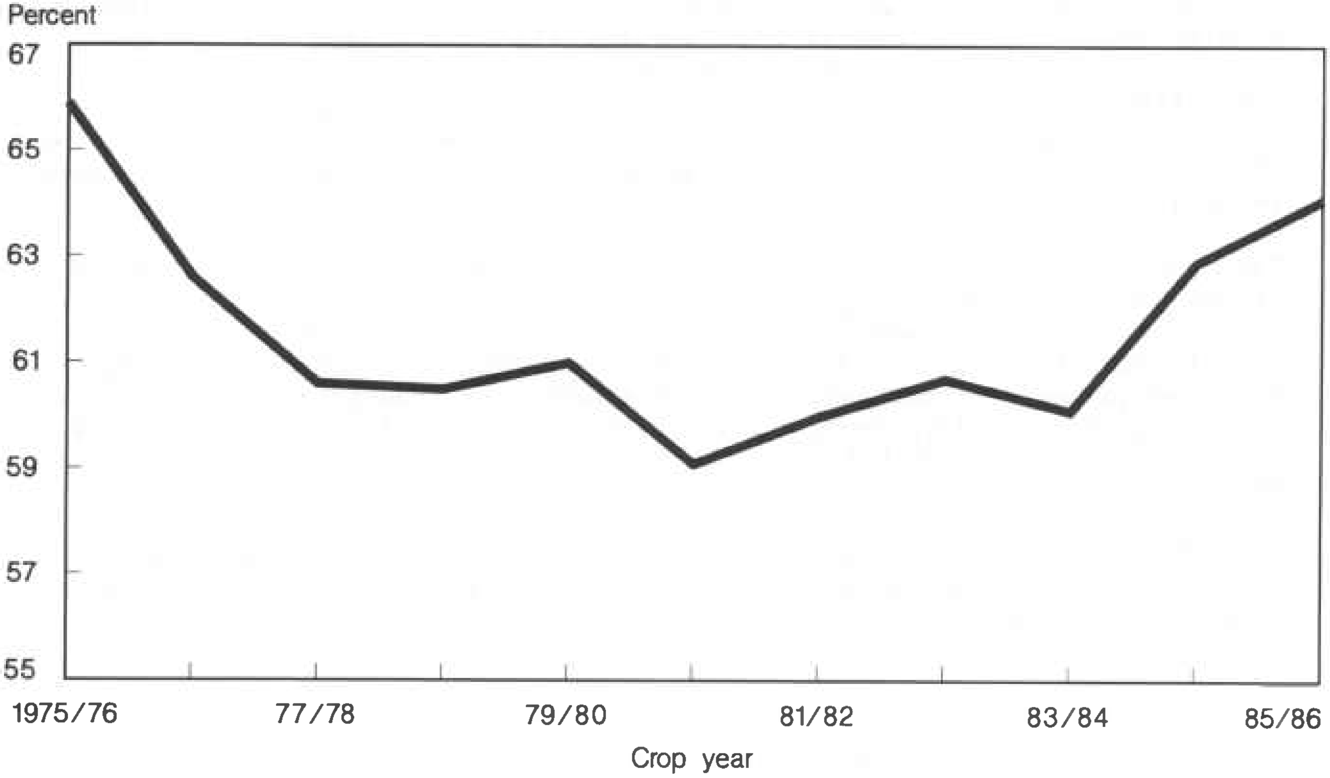
Calendar years	Cotton 2/ (1)	Polyester (2)	Difference (1)-(2)	Cotton's share of mill use
	------- Cents per pound -------			Percent
5-year averages:				
1955-59	34.9	143.0	-108.1	65.0
1960-64	32.0	114.0	-82.0	59.3
1965-69	29.1	65.6	-36.5	47.4
1970-74	42.4	39.0	3.4	36.5
1975-79	64.1	54.2	9.8	28.3
1980-84	78.0	77.5	.5	25.8
1985	65.6	66.3	-.7	25.3

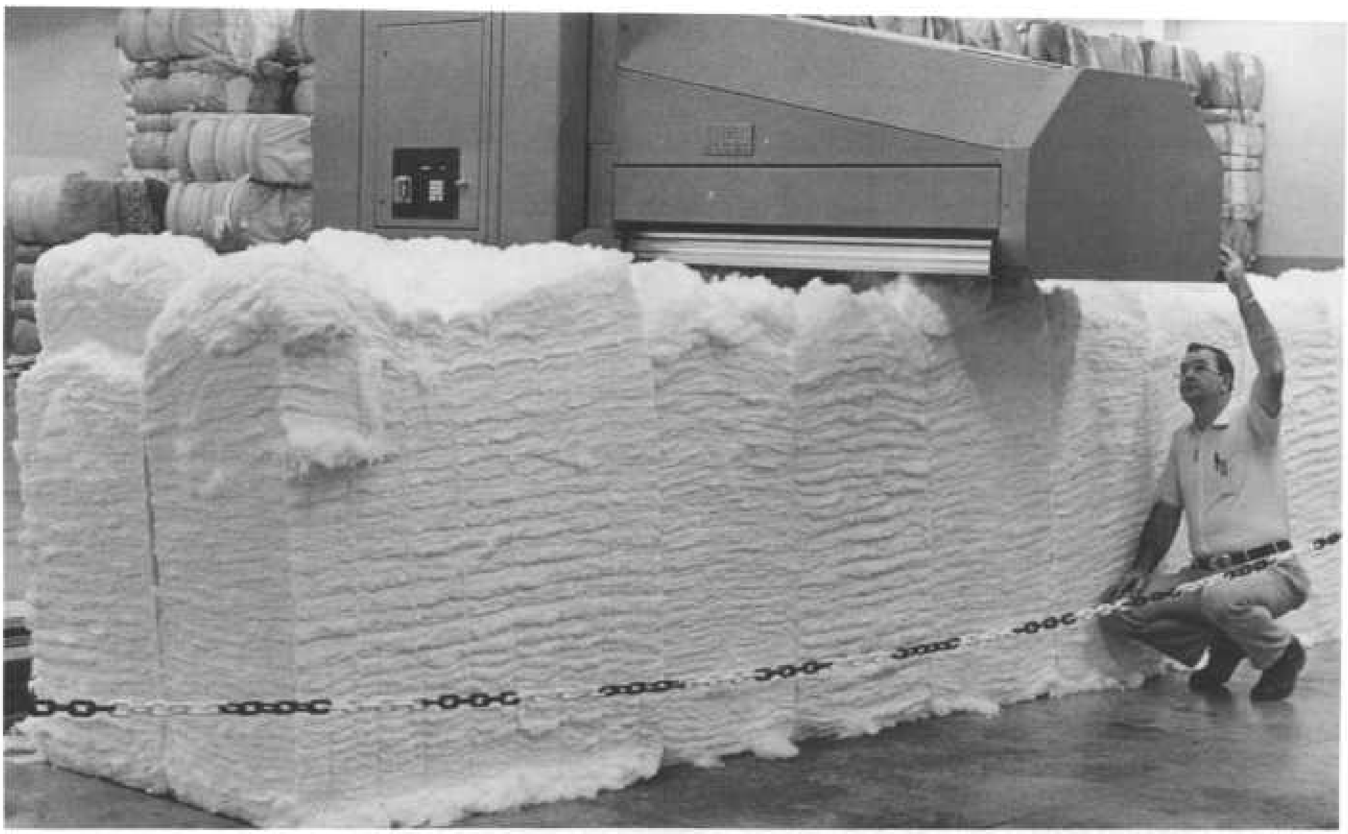
1/ Group B mills are textile mills in the western half of North and South Carolina.
2/ Middling 15/16 inch, 1955 through 1966; Strict Middling 1-1/16 inches, 1966 through 1969; and Strict Low Middling 1-1/16 inches, 1970 through 1985.

Sources: Compiled from Agricultural Marketing Service, USDA, and trade reports.

Figure 7

Cotton's share of fiber use





Opening and blending machines are used to mix cotton with other fibers prior to spinning and further textile processing. (American Textile Manufacturers Institute photo)

U.S. Cotton Textile Trade Deficit

The United States now runs a cotton textile trade deficit which accounts for over 30 percent of domestic consumption (table 20). Lower textile wages in foreign countries are the main reason for the U.S. cotton textile trade deficit. Also, relative currency strengths and rates of economic growth in the United States and other countries can cause the trade deficit to widen or narrow. During 1960-84, cotton textile imports grew at an average annual rate of about 6 percent, although import growth during 1980-84 averaged 19 percent per year.

Most U.S. textile exports move to Canada and Western Europe. The United States has a textile trade surplus with those countries. Wages in Canada and Europe are similar to wages in the United States, so U.S. manufacturers are able to compete in the markets of those countries for high-valued products. Also, no quotas restrict textile trade between the industrialized countries, except Japan. In 1981, about one-fifth of U.S. cotton textile exports went to Canada and about one-third moved to Western Europe, primarily Italy and France. Few U.S. textile exports go to the Far East.

In contrast, over 80 percent of U.S. cotton textile imports come from nine countries in Asia plus Peru and Brazil. Hong Kong, China, Taiwan, Pakistan, Korea, India, Japan, Singapore, and Thailand are the major exporters in Asia.

Table 20--History of the U.S. cotton textile trade deficit

Calendar years	Annual average textile trade 1/			Balance as percentage of domestic consumption 3/
	Imports	Exports	Balance	
	1,000 bales 2/			Percent
5-year averages:				
1940-44	40.6	517.6	477.0	---
1945-49	35.7	944.1	908.4	---
1950-54	83.1	652.7	569.6	---
1955-59	239.9	534.1	294.2	---
1960-64	564.8	464.1	-100.7	1.1
1965-69	947.0	405.0	-542.0	5.6
1970-74	1,096.9	597.4	-499.5	6.0
1975-79	1,446.2	821.5	-624.7	8.6
1980-84	2,199.0	656.0	-1,543.0	21.2
1985	3,079.7	439.5	-2,640.2	30.9

--- = Not calculated when exports exceed imports.
1/ Raw fiber equivalent basis.
2/ 480-pound net-weight bales.
3/ Calculated for deficit years (negative balance) only.

Source: (24).

Exporters of growing importance include the Philippines, Indonesia, Sri Lanka, Macau, Mexico, and the Dominican Republic.

On average, between one-fourth and one-third of the cotton contained in U.S. textile imports is grown in the United States, so growth of textile imports causes some increase in cotton exports. Cotton textiles produced in Korea and Taiwan probably contain more than 80 percent U.S. cotton. About one-third of the cotton used in Japan and Thailand comes from the United States, but textile imports from Hong Kong, China, Peru, India, Pakistan, and other cotton producers contain almost no U.S. cotton. In general, world textile production is moving away from countries heavily dependent on U.S. cotton imports and toward countries that either grow their own cotton or are located nearer to competing cotton exporters.

U.S. Cotton Exports

During 1945-75, U.S. exports of raw cotton accounted for about one-third of total cotton disappearance, but in the 1980's account for about one-half (table 21). Several times during the late 1970's and 1980's, U.S. exports exceeded domestic mill use. During the 1985/86 season, however, U.S. prices were supported above prices charged by competing exporters and U.S. exports dropped to about 2 million bales.

The primary export markets for U.S. cotton have been Japan, South Korea, Taiwan, and Hong Kong. During 1978-81, China was also a major customer. Canada, Thailand, and Europe are becoming increasingly important export destinations. As textile industries continue to move toward countries with lower labor costs, U.S. export destinations will probably become even more diverse.

Table 21--Annual average U.S. mill use and exports of raw cotton

Years	Mill use	Exports	Disappearance	Exports as percent of disappearance
	1,000 bales 1/			Percent
5-year averages:				
1940-44	10,646	1,441	12,087	11.9
1945-49	9,415	4,234	13,649	31.0
1950-54	9,705	4,306	14,011	30.7
1955-59	9,070	5,518	14,588	37.8
1960-64	9,048	5,274	14,322	36.8
1965-69	9,096	3,603	12,699	28.4
1970-74	7,779	4,493	12,272	36.6
1975-79	6,653	5,798	12,451	46.6
1980-84	5,592	6,147	11,739	52.4
1985	6,410	1,965	8,375	23.5

1/ 480-pound net-weight bales.

Source: (24).

Foreign mills purchase both the highest and lowest quality U.S. cotton. Up to 80 percent of the high-quality production from California, Arizona, and New Mexico is exported to mills in Japan, Korea, and Europe for use in production of high quality textile products. Lower grade, shorter staple length cotton, particularly from Texas and Oklahoma, often moves toward mills in Taiwan, Hong Kong, and other Far East countries for production of coarse-yarn textile products such as denim and corduroy.

Mill use of cotton declined at a compound annual rate of about 2.5 percent from 1965-69 to 1980-84, while exports grew at a compound annual rate of about 3 percent. As a result, annual disappearance of U.S. cotton averaged about 12 million bales during that period. No statistically significant trend in total use developed.

Export demand generally shows a greater sensitivity to price changes than does mill use. Cotton is produced in about 75 countries. An increasing number of these countries are seeking to expand their foreign exchange earnings through the export of cotton. Consequently, a small change in U.S. prices can sometimes engender a large shift in world trade patterns. Some recent estimates indicate that a 1-percent increase in U.S. cotton prices will cause a 0.5-percent decrease in U.S. exports during an ensuing year, other factors held constant. U.S. mills, on the other hand, have only U.S. cotton to choose from as import quotas on raw cotton limit shipments from other countries. Consequently, larger price changes are required to shift U.S. mill use significantly.

Competition among cotton exporters may remain strong during the late 1980's. Local-currency cotton prices in countries such as Mexico, Argentina, and Australia provide a strong production incentive in relation to dollar prices. The governments of Sudan, India, Pakistan, and China support domestic textile industries by encouraging cotton production. Double cropping of wheat and cotton may become more commonplace in China. The World Bank is heavily involved in boosting Sudanese cotton production. The economies of Zimbabwe, Uganda, and Iran are recovering from civil war and revolution; production in these areas could rebound. However, lower U.S. prices under the Food Security Act of 1985 beginning in 1986/87 have returned U.S. cotton exports to the long-term average of about 9-10 percent of total foreign mill consumption.

Distribution and End Uses

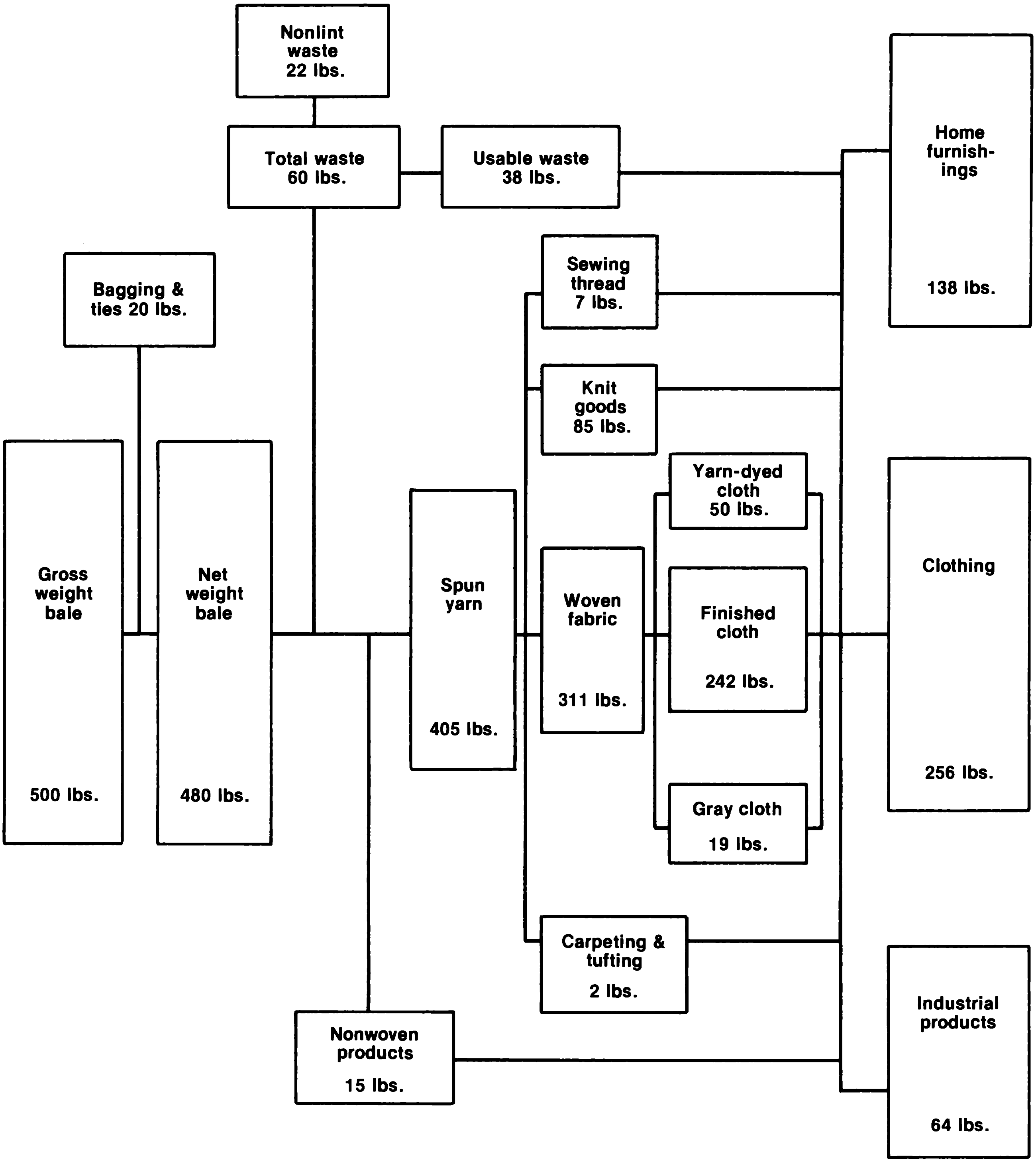
The path from raw fiber to finished consumer product may take many diverse forms. Figure 8 shows the breakdown of an average bale of cotton among specific applications.

Distribution of an Average Bale

Upon delivery to the textile mill, a bale of raw cotton averages about 500 pounds. Of this total, approximately 20 pounds, or 4 percent, is bagging and metal ties or bands ("tare"). However, an increasing volume of cotton is wrapped with improved materials which may weigh as little as 7 pounds. The remaining 480 pounds of cotton contain an average of 22 pounds of nonlint waste such as dust and vegetable matter. An additional 38 pounds of usable waste is produced in the first stages of the yarn production process. This usable waste is sold to the textile waste industry which uses it primarily for padding and upholstery filling. About 15 pounds go into nonwoven products.

Figure 8

Distribution of an average bale of U.S. cotton



On the average, a net weight of 405 pounds, or slightly over 81 percent of the original bale, is manufactured into yarn. About 85 pounds are used to produce knit goods, 7 pounds are made into sewing thread, and carpet and tufting yarns account for 2 pounds. The largest share of total yarn production, 311 pounds or nearly 77 percent, is woven into fabric.

Finished cloth (bleached, dyed, and printed) is the primary outlet for cotton fiber with approximately 242 pounds, or more than one-half of the original bale, consumed in this use. Unfinished gray goods, which are raw unbleached fabrics, account for 19 pounds and are used primarily for industrial applications. Nearly 50 pounds, or 16 percent of all weaving yarns, are used to produce yarn-dyed fabrics where yarn is first dyed and then woven. Most cotton denim products are constructed from yarn-dyed fabric and account for a significant share of total cotton use (over 1 million bales in 1984/85).

Except for waste and tare, all of the original bale of cotton ends up in the three major end-use categories: apparel, household, and industrial production. Products range from shirts to sheets to fire hoses. Clothing accounts for about 256 pounds or 56 percent of total end use of a bale. The manufacture of household goods consumes 138 pounds, and industrial uses account for about 64 pounds, including an estimated 38 pounds of useable textile waste indirectly used in household and industrial products and 15 pounds of fiber used to manufacture nonwoven products.

Table 22 shows the quantity of raw cotton consumed in 1984 in the three major cotton end-use markets, by type of fabric construction. Woven fabric accounts for nearly 61 percent of all fabric in apparel, but represents over 95 percent of that used in all home furnishings.

Specific Cotton End-Use Markets

Men's and boys' apparel accounts for about 36 percent of total domestic mill consumption of cotton, or about 2.1 million bales out of a total of 5.9 million used (table 23). Trousers and shorts are the most important items within this category. Cotton's market share of all fabrics used in trousers and shorts rose from 61 percent to 65 percent between 1982 and 1984, and

Table 22--Major cotton markets by type of fabric construction, 1984

Market	Fabric construction			Total
	Woven	Knit	Other 1/	
	1,000 bales			
Apparel	1,904	1,225	0	3,129
Household products	1,635	36	44	1,715
Industrial uses	538	8	150	696
Total	4,077	1,269	194	5,540

1/ Includes tire cord, tufting yarns, thread, rope, cordage and twine, and nonwovens.

Source: (15).

cotton's share of the denim market rose from 84 percent in 1982 to 90 percent in 1984. The next largest market is women's and misses' apparel where 891,000 bales were consumed in 1985. Slacks, jeans, blouses, and skirts are important items in this category. In the household products market, towels and wash cloths represent about 38 percent of the total use of cotton. About 93 percent of the fibers used in towels and wash cloths are cotton. Bed linens, drapery, upholstery, and slipcovers are other important markets in this category. Cotton consumed in all industrial uses totaled 739,000 bales, with medical supplies the largest market in this area. Rope, cordage, twine, and industrial thread are also included in this category.

Table 23--Major cotton end-use markets, 1984

Product	Cotton content: Equivalent 480-pound bales 1/	Cotton content: Market share 2/
	Thousands	Percent
Apparel	3,136	38
Men's and boys'	2,011	48
Women's and misses'	837	25
Girls', children's, and infants'	288	35
Home furnishings	1,707	18
Bedspreads and blankets	94	32
Draperies and upholstery	288	22
Retail piece goods	141	26
Sheets and pillow cases	355	42
Towels and wash cloths	643	93
All others	194	30
Industrial uses	697	17
Abrasives	50	88
Automobile uses	28	6
Cotton bags	11	100
Medical supplies	155	57
Rope, cordages, and twine	44	11
Shoes and boots (excludes waterproof footwear)	44	40
Tarpaulins (woven)	61	56
Thread (industrial)	94	32
Wiping and polishing cloth	28	88
All other	182	5
Total, all uses	5,540	25

1/ Raw cotton content of textile products adjusted for processing losses.
2/ Cotton materials consumed as a percentage of all textile materials used in a specific category.

Source: (15).

Cotton accounts for about 38 percent of all fibers used in apparel, 18 percent of the home furnishings, and about 12 percent of the fibers used in industrial products.

COTTON PRICING

Cotton prices represent the combined results of global cotton supply and demand forces. Some important factors affecting the annual supply of cotton include (1) the relative profitability of cotton versus competing crops, (2) U.S. and foreign government policies and programs and, (3) the availability of production inputs. On the demand side, major determinants are (1) prices of raw cotton and competing fibers, (2) domestic demand for textiles, (3) export demand for raw cotton and processed textiles, and (4) consumer incomes and levels of economic activity.

The price of cotton responds rapidly to actual and anticipated changes in market forces. Both cash and futures prices provide a broad base for market transactions. Also, all major growths of cotton are substitutable for each other either directly or indirectly, and all qualities of cotton have a direct market relationship to each other based on relative spinning values.

There is no single price for cotton. Rather, on any given day there are many prices depending on the form, type, quality, and location of a particular bale (3). Even the term "average price" has many meanings as the price of cotton is regularly averaged at four levels of the marketing system: farm, cash market, mill delivered, and northern Europe. Prices are also averaged by State and in designated cash markets. Prices on the New York futures market are averaged. This section describes the cotton price series most often quoted, the characteristics of cotton which most often affect prices, and the relationships between different cotton price series.

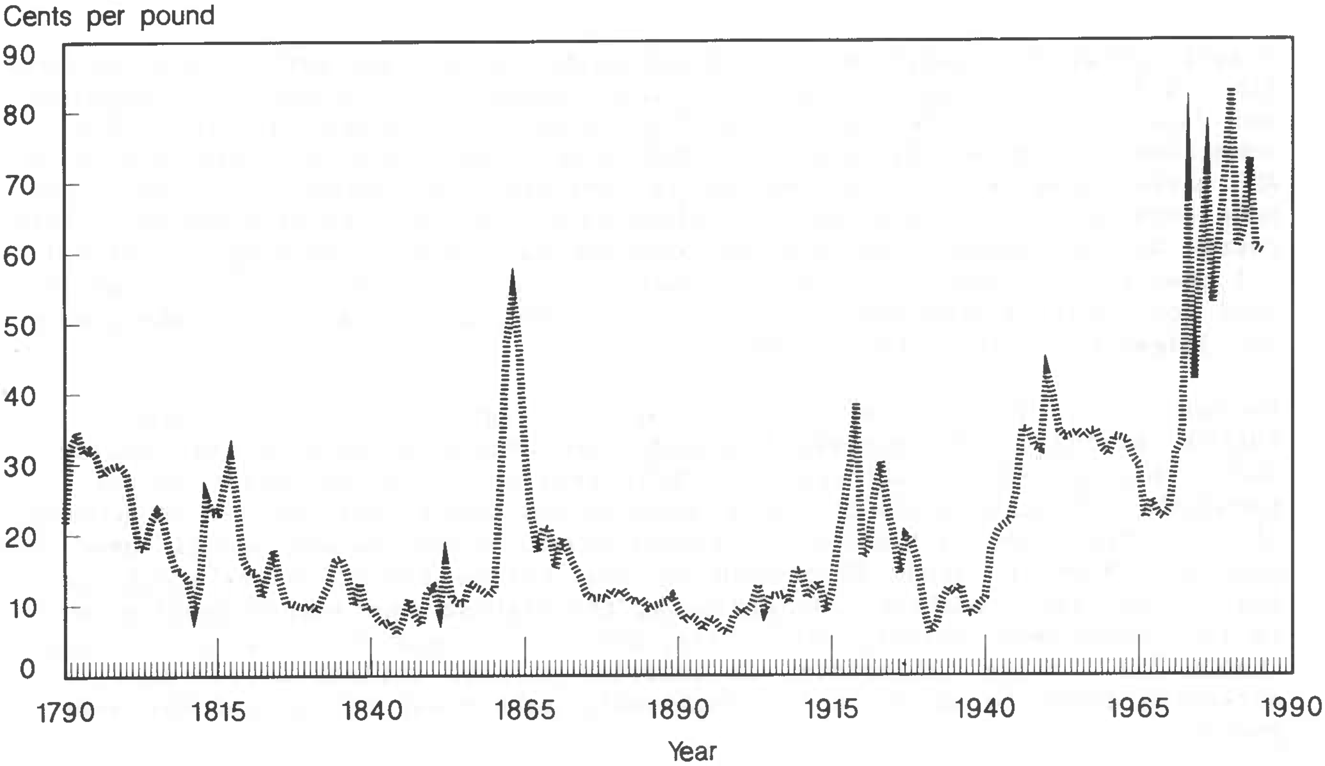
Spot Prices

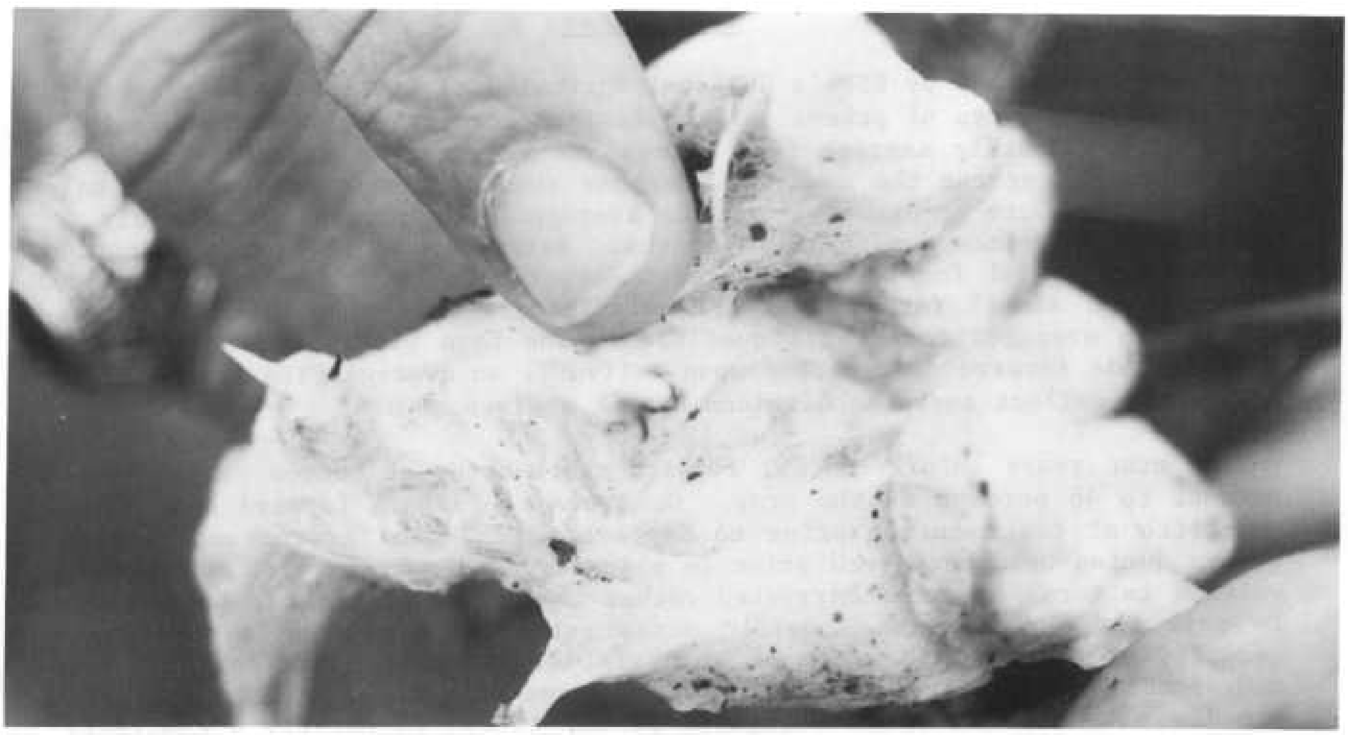
Probably the most representative price of U.S. cotton on any day is the average spot market, or cash price, quoted by USDA's Agricultural Marketing Service (AMS). This price is the average quoted for the base quality in each spot market on each day. The average is not weighted by the volume traded in each market. Unlike farm prices which are averaged over all qualities, the average spot price is specific to cotton of the base grade and staple length.

AMS first designated spot markets and began collecting cotton market price information in 1915. However, cotton was an important export commodity soon after the Revolutionary War. A history of cash prices from the New York spot market beginning in 1790 is shown in figure 9. During 1790-1914, staple lengths were not specified when spot prices were quoted, but middling was the base grade.

Between 1915 and 1972, the base grade remained Middling, and the base staple length ranged from 7/8 inch to 1 inch. Since 1973, the base grade and staple length has been Strict Low Middling (SLM) 1-1/16 inches, but less than 3 percent of the 1982 through 1984 crops were in that grade and staple length category. During the 1982, 1983, and 1984 crop years, 10 percent of Upland cotton ginnings equaled 1-1/16 inches, 23 percent were shorter, and 67 percent were longer. Strict Low Middling accounted for 24 percent of the 1982 through 1984 crops; 21 percent graded higher and 55 percent graded lower.

Figure 9
Season average U.S. spot market prices





The amount of debris in the raw cotton is one of many factors used to determine the spot price a farmer will receive from the purchaser. (USDA photo)

The eight designated spot markets from which AMS collects cash price data include Greenville, SC; Montgomery, AL; Memphis, TN; Greenwood, MS; Dallas, TX; Lubbock, TX; Phoenix, AZ; and Fresno, CA. Augusta, GA; Houston, TX; Atlanta, GA; and Little Rock, AR, were dropped as designated spot markets between 1974 and 1983.

A spot quotations committee in each designated market estimates the price for SLM 1-1/16 inch cotton in its market area, along with a schedule of premiums and discounts from the base price for cotton of different quality. The committee is composed of prominent traders working within each market plus an AMS market news reporter who serves as committee chairperson. Estimates are made each day after the close of trading on the New York futures market. Most cotton market transactions are not reported to organized exchanges, and not all qualities of cotton are traded each day in each market. In cases where data for actual market transactions are not available, committee members must use judgment in estimating prices.

Because daily spot prices are for a specific grade and staple length of cotton, prices in the markets farthest from consuming centers are usually lower than prices in markets near U.S. textile mills and major export terminals. Textile mills in North Carolina and South Carolina used 60 percent of the cotton used in the United States; mills in Alabama and Georgia used 30 percent. However, about 70 percent of U.S. cotton exports move through Los Angeles and San Francisco. Accordingly, the highest spot prices usually occur in the easternmost market, Greenville, and in the westernmost market, Fresno (table 24). Price differences in interior markets reflect differences in marketing costs to mills in the Southeast, gulf coast ports, and Far West ports.

Farm Prices

Farm prices reported by USDA's National Agricultural Statistics Service (NASS) are based on surveys of prices paid to farmers for cotton lint at the point of first sale. Monthly average farm prices are weighted by volume of sales in each State and across the country. Because about three-fourths of farm sales occur during October-January, annual average farm prices are largely determined by prices during those months. Estimates of the value of cotton held as collateral for Commodity Credit Corporation (CCC) loans are included when average annual farm prices are calculated. Unlike spot prices, farm prices are averaged across all qualities. The farm prices reported by NASS also include forward contracting upon delivery, so average farm prices may not accurately reflect market conditions during a given month.

During crop years 1976/77-85/86, forward contracting of cotton ranged from 6 percent to 48 percent of the crop. On average, farmers forward sell about one-fifth of their cotton prior to September 1. Much forward contracting occurs during December-March prior to planting, and most forward contracts are written in terms of acres harvested rather than bales. That is, farmers agree to sell the harvest from specific acres rather than selling a specific quantity of cotton. In years of high yields, the farmer has sold all the unexpected production from the contracted acres at a fixed price. When yields are low, the farmer is not obligated to buy cotton to satisfy a contract. Forward contracts are written in terms of a base quality; the CCC schedule of discounts and premiums determine the value of cotton of different quality.

Table 24--Spot price differentials across designated markets, 1970-84

Crop year	Greenville, SC: actual	Discount or premium from Greenville: Mont., AL	Memp., TN	Greenwood, MS	Dal., TX	Lubbock, TX	Phoenix, AZ	Fresno, CA	Group B 1/
	Cents per pound								
1970	23.98	-0.16	-0.20	-0.35	-0.67	-0.70	-1.27	-1.07	4.57
1971	31.79	.16	-.07	-.14	-.71	-.45	-.81	-1.12	4.47
1972	33.36	1.95	-.91	0	-2.09	-1.00	-1.06	-1.19	5.92
1973	68.06	.38	-.05	0	-4.31	-6.19	-1.80	3.48	3.62
1974	42.80	-.35	-.94	-.60	-2.49	-3.90	-2.28	-.27	3.69
1975	59.19	-.26	-.71	-.65	-3.35	-4.13	-1.99	-.47	3.17
1976	71.85	-.30	-.57	-.64	-2.41	-4.05	-1.73	-.08	4.05
1977	53.33	-.09	-.58	-.59	-2.81	-3.29	-.34	-3.34	5.06
1978	62.09	-.17	-.41	-.25	-3.76	-3.82	-.11	-5.57	6.50
1979	73.24	-.67	-.69	-.51	-6.33	-6.81	-1.26	-.52	4.97
1980	84.54	-.26	-.72	-.24	-3.89	-4.88	-2.84	-1.74	6.45
1981	61.57	-.23	-.57	-.23	-3.25	-3.61	-1.63	-.55	6.87
1982	63.50	0	-.17	-.14	-1.88	-2.66	-.08	-.99	8.14
1983	73.28	-.36	-.03	-.14	-2.50	-2.93	-.84	-3.73	8.22
1984	61.08	-.52	-.36	-.10	-2.14	-2.16	-.48	-.21	6.81
Avg.	57.58	-.06	-.47	-.31	-2.84	-3.37	-1.05	-.77	5.50

1/ For cotton delivered to textile mills in western North and South Carolina.

Source: Based on data developed from reports of the Cotton Division, Agricultural Marketing Service, USDA

During crop years 1976/77-85/86, Delta farmers forward contracted an average of 32 percent of their acreage by September 1 of each crop year. Forward contracting averaged 25 percent in the Far West, 21 percent in the Southeast, and 12 percent in the Southwest. The proportion forward sold in the Southwest is low because yields are so variable on the High and Rolling Plains of Texas and Oklahoma that forward buying is not generally attractive to merchants.

Forward contracts are usually either "fixed-price" or "call" contracts. Fixed price contracts set the price of the base quality in specific cents per pound. Call contracts fix the basis between the price received by the farmer and a futures contract. A farmer then has the option to call the buyer anytime prior to expiration of the futures contract and settle on the actual price. Call contracts allow farmers and cotton buyers to use futures contracts as perfect hedging tools, although few cotton farmers actually hedge their production with futures contracts.

Compared with spot prices, farm prices show greater variation across States because of the differences in average quality of cotton produced in each area, as well as differences in distance to major markets (table 25). Still, the geographic pattern is the same for spot and farm prices. The lowest farm prices in the country are in Texas and Oklahoma. Usually about 13 percent of the cotton produced in Texas and Oklahoma is graded Strict Low Middling or better, and over 43 percent of those crops are shorter than 1 inch. The low average quality plus distance to market causes Southwest farm prices to average about 8 cents a pound less than prices in North Carolina and South Carolina and 9 cents less than prices in California.

On average, 83 percent of California production is graded Strict Low Middling or better, and nearly 99 percent of California cotton is 1-1/16 inches or longer. High quality and close proximity to export terminals in Los Angeles and San Francisco explain why California farm prices are nearly always the highest in the country. Cotton grown in Arizona averages Strict Low Middling or better 61 percent of the time, and 89 percent of the cotton is 1-1/16 inches or longer. Arizona cotton is consequently usually lower priced than California cotton. New Mexico farm prices are often higher than Arizona prices because two-thirds of New Mexico's production is usually 1-1/4 inches or longer, compared with 19 percent of Arizona production. The quality of cotton produced in the Delta is similar to that produced in North Carolina and South Carolina, so a large part of the price differences in these regions reflect transportation costs to mills and export terminals.

The annual average farm price is usually about 5.5-7 cents per pound less than the annual average spot market price for SLM 1-1/16 inch cotton. The difference is accounted for by transportation and merchandising costs between farms and spot markets, and by the fact that most cotton is lower grade than the base quality.

Prices for Mill-Delivered Cotton

The Group B mill price refers to the price of a specific quality of cotton delivered to mills in the western half of North Carolina and South Carolina. The price includes all associated transportation and marketing costs. Like farm prices, mill prices are affected by forward purchases of cotton, as well as hedges placed with a futures contract. Therefore, monthly changes in Group B Mill prices may not strictly reflect only current market conditions. Still, the annual average mill-delivered price of SLM 1-1/16 inch cotton can be

Table 25--Farm price differentials

Crop year	Actual SC	Premium or discount from SC											
		NC	GA	AL	MS	TN	AR	LA	TX	OK	NM	AZ	CA
		Cents per pound											
1970	23.32	0.15	-0.76	-0.39	-0.47	-0.33	-0.12	-0.30	-1.90	-2.49	1.32	0.27	1.97
1971	29.11	.15	.17	-1.06	-1.47	-1.41	-1.38	-.95	-2.54	-.74	.86	.84	2.44
1972	29.40	2.20	-.50	-1.50	-.20	-1.84	-.80	-1.06	-6.40	-3.50	.80	.10	1.80
1973	51.10	8.50	7.90	-7.10	-13.20	-11.40	-16.40	-13.60	-5.10	-1.60	-1.10	-7.80	-1.60
1974	49.20	-7.30	-8.10	-6.20	-2.70	-8.10	-3.90	-7.40	-14.30	-19.30	-4.70	-5.10	-1.80
1975	53.90	.60	1.60	1.00	-1.40	-1.60	-1.70	-1.10	-8.10	-6.70	.70	-.80	.60
1976	66.40	7.60	.30	-.40	-4.90	-2.90	-4.80	-2.70	-4.80	-5.30	3.60	-2.20	1.50
1977	54.10	-3.60	-2.30	-5.70	-1.60	-5.10	-1.40	-2.60	-4.40	-7.50	-.10	2.00	1.90
1978	62.70	2.70	-2.50	-2.40	-2.70	-1.50	-2.60	-2.70	-9.00	-8.80	-.70	-5.30	1.20
1979	66.20	-1.50	-.70	-.90	-2.70	-3.30	-.90	-2.20	-10.50	-6.50	2.30	1.90	2.70
1980	79.60	-.10	-1.70	-.40	-3.20	-1.30	-2.90	-1.80	-11.10	-3.00	1.40	-5.40	-1.80
1981	57.70	.70	-3.40	-1.80	.70	-4.60	-.90	-3.20	-11.20	-16.60	2.30	-1.70	-1.70
1982	59.70	1.70	-3.10	-1.20	.10	-2.00	-1.70	-3.20	-8.40	-10.20	12.40	.80	7.20
1983	72.40	-1.90	-5.20	-6.70	-6.20	-3.90	-5.90	-7.00	-13.10	-14.60	1.80	-4.20	.40
1984	61.30	1.70	-2.10	-5.40	-5.20	-4.40	-5.10	-6.20	-6.20	-12.60	.80	-2.40	4.50
Average	54.41	.77	-1.36	-2.68	-3.01	-3.58	-3.37	-3.73	-7.80	-7.96	1.45	-1.95	1.29

Source (29).

compared with spot prices for a measure of transportation costs to mills, storage costs on cotton prior to mill delivery, and merchandising expenses. During 1970-84, mill prices for SLM 1-1/16 inch cotton averaged about 5.5 cents a pound higher than spot prices in Greenville, SC (table 24). Transportation costs between Greenville and Group B mills are low, so most of the difference would reflect storage and merchandising expenses.

The difference between mill-delivered and Greenville spot prices rose during 1980-83, and averaged over 8 cents in 1982/83. Smaller quantities of cotton being sold to mills may have caused average merchandising expenses to rise. Increased storage costs since 1980 would also explain the rise in the average spread between mill and Greenville prices. When interest rates rose beginning in 1979, mills reduced their own inventories of raw cotton. Consequently, the average length of storage and storage charges on purchased bales increased. Transportation charges probably also rose after 1980, as mills ordered smaller quantities for faster delivery.

International Prices

More than 100 countries trade in raw cotton, and many countries use grading systems, units of measurement, and transportation, storage, and packaging systems that are different from those used in the United States. Some cotton is traded by barter, and many countries isolate their domestic markets from world markets. Few countries have organized commodity markets in which cotton is traded by public outcry. Therefore, determining the actual price of cotton in a foreign country is often difficult.

Two summary measures of international prices often used are the Outlook "A" and "B" indexes. The indexes are published by Liverpool Cotton Service, Ltd., in a weekly publication, Cotton Outlook, and represent average delivered prices that foreign sellers offer to textile mills for cotton delivered to northern Europe within the past 3 months. The "A" index is the average of the 5 lowest prices of 10 prices quoted in northern Europe for Middling 1-3/32 inch cotton. Prior to 1981/82, Strict Middling 1-1/16 inch cotton was the international base quality. The "B" index is an average of the three lowest prices of six prices quoted for coarse count, or low grade, cotton.

The "A" and "B" indexes are not weighted by quantity traded and shipment dates often vary by several months for different types of cotton used to compute each index. Also, prices are quoted in U.S. dollars, so changes in local currency prices may be obscured. Another problem from the perspective of the United States in using prices from Europe as an index of international prices is that most U.S. cotton exports go to East Asia.

The international base grade of U.S. cotton delivered to northern Europe is usually 2-3 cents a pound above the "A" index (table 26). However, during the 1985/86 season, U.S. prices were supported above prices charged by competing exporters and U.S. exports fell to about 2 million bales. In the past 20 years, only once (1983/84) did U.S. cotton sell cheaper than the "A" index, reflecting drought in several foreign countries and the availability of PIK entitlements. Transportation costs to northern Europe from Turkey, West Africa, and the Soviet Union are lower than from the United States. Cotton from those countries tends to pull down the average. During years in which demand for U.S. cotton in Asia was especially strong, U.S. prices in northern Europe rose more than 6 cents above the "A" index.

U.S. spot prices are often 12-16 cents below delivered prices for U.S. cotton in northern Europe, reflecting chiefly transportation and marketing costs. During the late 1970's, export freight rates for container cargo gradually rose, and the difference between spot and delivered northern Europe prices of

Table 26--"A" Index and price per pound of U.S. cotton delivered to northern Europe

Year beginning August 1	"A" index 1/	U.S. Memphis territory 2/
	Cents per pound	
1960	---	29.46
1961	---	30.23
1962	---	29.75
1963	29.18	29.12
1964	29.03	29.49
1965	28.13	28.47
1966	28.35	28.35
1967	31.30	33.32
1968	28.75	29.97
1969	28.00	28.82
1970	31.10	31.67
1971	37.15	37.43
1972	41.95	43.54
1973	76.50	78.31
1974	52.50	56.41
1975	65.26	71.41
1976	81.75	82.47
1977	65.01	65.25
1978	75.99	75.99
1979	85.46	87.76
1980	93.30	101.22
1981	73.76	75.87
1982	76.65	77.95
1983	87.61	87.09
1984	69.18	73.90
1985	48.92	64.81

--- = Not calculated for 1960-62.

1/ The "A" index is an average of the cheapest five types of SM 1-1/16" staple length cotton offered on the European market. The grade and staple length used to calculate the index was changed to Middling 1-3/32" in July 1981. Calculations for 1963-72 were made using data published in Statistics on Cotton and Related Data, 1960-78.

2/ Cotton grown in the Mississippi Delta region.

Source: Based on data from Cotton Outlook. Liverpool Cotton Services, Ltd., Liverpool, England.

U.S. cotton rose to about 18 cents a pound. During 1981/82-84/85, freight rates declined on cargo leaving the United States; the U.S.-northern Europe basis declined to about 13 cents a pound.

Most U.S. cotton exports are destined for Asia. Japan is usually the largest importer of U.S. cotton. The c.i.f. Osaka price of U.S. cotton, Strict Low Middling 1-1/16 inches, varies between 3 and 9 cents per pound cheaper than U.S. cotton in northern Europe. The basis between prices in Osaka and northern Europe reflects lower costs of transportation to the Far East from the U.S. west coast, and lower merchandising costs per pound to the Far East due to larger trade volumes. Variance in the basis between Osaka and northern Europe prices is caused by changes in freight rates to each region, relative supply and demand conditions in each region, and problems in measuring exact prices.

Futures Prices

Just as cotton prices vary by quality and with distance from consuming centers, prices also vary with time prior to mill use. The New York Cotton Futures Exchange, established in the 1870's, survives today as the major established market for trading cotton futures in the United States. It is also used by many foreign countries for hedging purposes. The New York contract is for 50,000 pounds of Strict Low Middling 1-1/16 inches cotton. The primary delivery dates are March, May, July, October, and December. Delivery points include Houston and Galveston, TX; Greenville, SC; Memphis, TN; and New Orleans, LA.

The heavily traded December contract is watched closely as an indicator of new-crop supply and demand conditions because December is the first delivery month following the harvest of a majority of the crop. Up to half of the cotton sold by farmers each year is priced in terms of a basis off December. The March, May, and July contracts are watched for indications of midseason changes in cotton demand, because the season's supply is known with virtual certainty by January. The October contract is influenced by the quality and quantity of early harvested cotton in south Texas, by changes in demand, and by expectations for the total harvest.

Spot and futures prices theoretically should have a predictable relationship. Spot prices should be less than futures prices, with the difference, or basis, representing the costs of storage plus delivery. As the contract delivery date approaches, the cost of storage to that date decreases, and the basis should narrow to only the cost of delivery and of certifying that the cotton meets contract specifications. Prices can vary from the expected pattern, however. As forecasts of supply, use, and ending stocks change, the market signals smaller or larger rewards for the storage of cotton. At times, when current supplies are tight but an expected good harvest holds out the potential for rising stocks, spot prices can exceed futures prices. The reverse can occur when fears of a shortage of cotton become prominent.

Cotton storage costs include warehouse charges for insured storage, interest income foregone on the value of the bale, and a risk premium determined by volatility of prices and expectations. The cost of transportation to a futures market delivery point depends on the point of origin. Transportation of Midsouth cotton destined for Memphis will cost less than 1 cent per pound, while delivery of Arizona cotton to Galveston may cost 2-3 cents per pound.

The cost of certification for delivery against a futures contract, including charges for compression, loading out, sampling, inspection, and classing, total about 4 cents per pound. Thus, in each delivery month, when carrying costs approach zero, the basis should narrow to about 5-6 cents per pound.

Price-Quality Relationships

Cotton quality affects net returns to individual farmers and can influence the absolute level of spot and futures prices. During years when high grade cotton accounts for a lower/higher than usual proportion of the total, the average spot price for high grade cotton can rise or decline in relation to other grades.

The two most commonly used measures of quality are grade and staple length (5). Grade refers to color and quantity of foreign material in the sample. Staple length is the average length, in 1/32 of an inch increments, of the longest 25 percent of the fibers in a sample.

During the 1982-84 seasons, Middling grade cotton brought an average of 1.58 cents per pound more than Strict Low Middling cotton, while Low Middling suffered an average discount of 5.23 cents from the base grade (table 27). Strict Low Middling Light Spotted cotton averaged 4.27 cents per pound cheaper than Strict Low Middling cotton, while Strict Low Middling Spotted cotton was 12.7 cents cheaper.

Just as discounts for low grades are greater than premiums for high grades, short staple cotton is generally discounted more than long staple is rewarded. From the base staple length of 1-1/16 inches, discounts for each thirty-second of an inch of staple length less than the base averaged about 2.2 cents per pound during 1982/84 while the premium for each thirty-second of an inch longer than 1-1/16 inch averaged about 0.6 cent per pound.

Other measurements of quality which affect cotton prices are micronaire (a measurement of fineness), fiber strength, percentage of mature fibers, and uniformity of fiber length. Micronaire is regularly used as a grading factor, with readings of 3.5-4.9 considered normal. Discounts are assessed for micronaire readings above and below the normal range.

Fiber strength is used increasingly as a pricing factor, especially on cotton sold to mills with rotor spinning equipment. However, official USDA market discounts and premiums associated with fiber strength are not yet collected. Other grading factors, like uniformity and percentage of mature fibers, are not commonly used in pricing cotton sold by farmers.

THE COTTON MARKETING SYSTEM

The production of several hundred combinations of fiber qualities and staple lengths adds to the complexities of efficient and effective cotton marketing. Distinct differences in fiber properties result from the numerous varieties produced and from variations in soil types, weather conditions, and harvesting and ginning practices. However, the diversity of modern textile methods and equipment ensures the need for cotton with distinct fiber properties. Depending upon the final product to be manufactured, a wide range of fiber characteristics may be required. This requirement is traditionally accomplished by blending and mixing bales of cotton with specific, known fiber properties in the first stages of textile processing. The effective matching of fiber properties to end-use requirements is critical to the competitiveness of textile firms. For foreign consumers of U.S. raw cotton, the wide range of qualities available in large supplies is a positive factor for U.S. export marketings.

Table 27-- Average cotton premiums and discounts from the base grade and staple, 1982-84 crops, points per pound 1/

Grade	Staple length 28	29	30	31	32	33	34	35	36	37
	Points per pound									
11	-992	-950	-776	-553	-355	-31	198	242	253	491
21	-972	-950	-776	-554	-358	-35	194	238	249	481
30	-997	-955	-801	-580	-387	-58	172	217	228	466
31	-1,004	-981	-809	-587	-415	-75	158	202	214	456
40	-1,057	-1,035	-863	-640	-649	-179	51	96	137	304
41	-1,084	-1,062	-890	-669	-514	-230	Base	43	75	195
50	-1,164	-1,142	-991	-766	-647	-517	-320	-291	-266	-184
51	-1,250	-1,229	-1,082	-877	-781	-705	-523	-500	-513	-284
60	-1,505	-1,486	-519	-1,356	-1,325	-1,242	-1,141	-1,122	-1,105	-926
61	-1,570	-1,550	-1,483	-1,425	-1,383	-1,335	-1,234	-1,217	-1,203	-1,104
70	-1,798	-1,778	-1,739	-1,701	-1,674	-1,690	-1,612	-1,597	-1,608	-1,637
71	-1,856	-1,837	-1,797	-1,763	-1,733	-1,773	-1,703	-1,687	-1,687	-1,670
12	-1,035	-1,012	-846	-618	-445	-145	61	104	139	206
22	-1,035	-1,012	-846	-618	-447	-150	57	100	135	198
32	-1,079	-1,054	-886	-663	-511	-240	-23	22	58	149
42	-1,176	-1,152	-1,012	-815	-703	-604	-427	-402	-404	-285
52	-1,417	-1,401	-1,292	-1,177	-1,115	-1,169	-1,069	-1,053	-1,091	-1,104
13	-1,258	-1,238	-1,136	-1,053	-989	-786	-640	-618	-701	-565
23	-1,258	-1,238	-1,136	-1,053	-990	-789	-643	-621	-703	-566
33	-1,336	-1,316	-1,217	-1,141	-1,091	-1,033	-893	-876	-912	-681
43	-1,478	-1,459	-1,387	-1,329	-1,270	-1,370	-1,270	-1,256	-1,300	-1,404
53	-1,639	-1,629	-1,569	-1,548	-1,529	-1,651	-1,593	-1,580	-1,639	-1,704

1/ Cotton grades are designated numerically using a system developed over time. Lower numbers generally designate better grades. Staple length is measured in 1/32 of an inch increments. The base grade and staple against which others are compared is Strict Low Middling (41) 1-1/16 inches (34). The highest premiums are paid for long cotton of the best grade (upper right corner); The biggest discounts are assessed against short, low grade cotton (lower left corner). 100 points equal 1-cent.

Source: Based on cotton price reports from the Cotton Division, Agricultural Marketing Service, USDA.

The primary function of the cotton marketing system, therefore, is to obtain and assemble adequate volumes of the desired qualities of cotton in locations such that a dependable and continuous supply is available to domestic and foreign users. In order to effectively and efficiently carry out these marketing requirements, numerous cotton gins, warehouses, merchandising firms, and others work cooperatively in the performance of certain basic activities:

1. Movement of harvested seed cotton from farms to local gins.
2. Separation of lint from the seed, baling and wrapping lint, and transporting bales to storage facilities.
3. Cotton storage, sampling, and other associated warehousing services.
4. Cotton merchandising activities.
5. Transportation of bales to domestic mills and foreign ports.
6. Fiber quality determination and testing.

While these basic activities of cotton marketing represent traditional functions of the system, numerous changes and adjustments have occurred in response to changing market conditions. During the past two decades, competition from manmade fibers, sharp increases in imported textiles, and steady growth in foreign cotton production have been important factors in shaping current cotton marketing services and practices. The emergence of the Far East as the major U.S. cotton export market has altered traditional distribution channels and transportation cost structures. Also, the return to more market-oriented cotton programs since the early 1970's allowed for wider swings in cotton prices and volumes, significantly affecting the number, size, and location of marketing firms. As a result, today's cotton marketing system has evolved into a highly efficient and interdependent network. The performance of activities at each stage in the marketing process is critical to the effective operation of successive stops along the marketing chain.

Overview of Marketing Flows

Marketing cotton from farms to domestic textile mills and foreign markets is a complex process involving the coordination of many physical services and merchandising activities. Cotton is marketed from 38,000 farms located in 17 States to over 3,000 domestic mills and 50 foreign countries. This process involves the services of nearly 2,000 gins, about 400 warehouses, and about 300 marketing firms.

Physical Movement

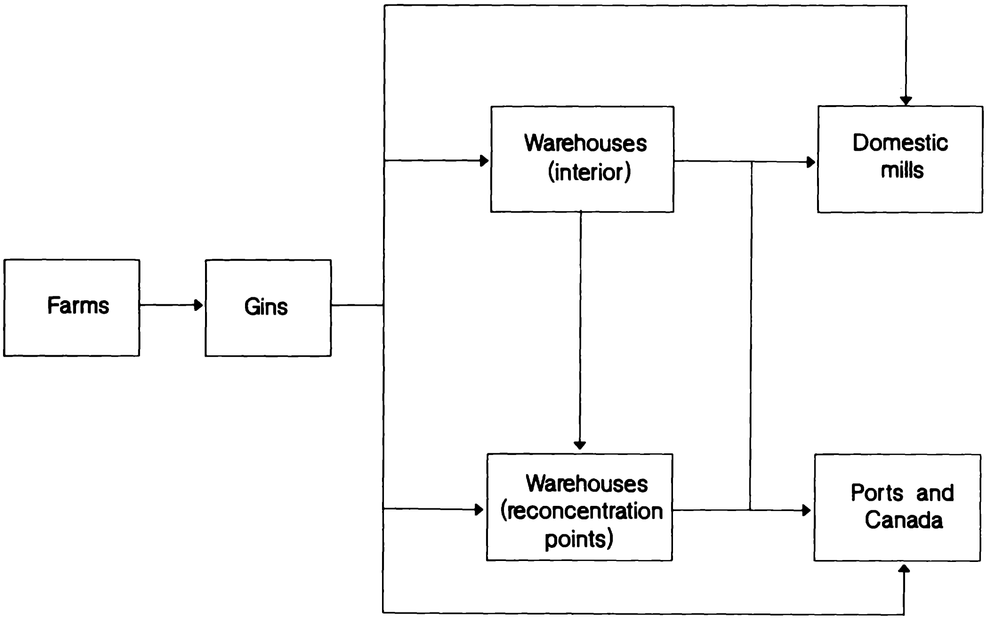
Cotton marketing begins when harvested seed cotton is assembled and hauled from farms to local gins (fig. 10). At the gin, the lint, seed, and trash are separated, and the lint is compressed into bales weighing 475-525 pounds.

From the gin, most bales are loaded onto trucks and moved to local warehouses for storage. Bales are weighed, sampled, and further compressed into a universal size and density. A negotiable warehouse receipt is issued which attests to the location and ownership of the bale. Cotton samples are sent to one of the 20 USDA cotton classing offices for quality determination, and the results are returned to the owner of the bale for use in marketing.

The distance of haul for most gin-to-warehouse movements may vary from a few blocks to about 100 miles. In some areas of the Cotton Belt, bales may be shipped longer distances directly to warehouses normally considered reconcentration points, especially if the final destination is known.

Figure 10

Physical flow of U.S. cotton



Shipment of cotton from interior warehouses to reconcentration points is primarily for consolidating bales into larger lots of like qualities for eventual movement to domestic and foreign mills.

Domestic textile mills typically maintain only a 30- to 45-day supply of cotton and must constantly replenish stocks. Therefore, bales are shipped from warehouses to mills in fairly even volumes throughout the year. In contrast, movements to ports and Canada for export follow stronger seasonal patterns. January, February, and March are the heavy export months.

Approximately one-third of the U.S. cotton crop moves directly from gins to domestic mills or ports, bypassing the traditional warehouse system. In the Southeast, cotton may move directly to mills without storage or further compression because of the closeness of textile facilities. In other areas, some bales are compressed to universal density at gins and loaded into containers and shipped directly to ports on the gulf and west coasts.

Ownership transfers

The chain of ownership transfers begins when the producer sells cotton, or pledges it as collateral for a loan from the Federal Government (USDA's Commodity Credit Corporation). Pledging cotton as collateral is not, in a strict sense, transferring ownership. The producer has the option of repaying the loan, plus interest and storage charges, and selling the cotton before the loan period expires and the Government takes title. The first transaction usually takes place at gin points where the cotton producer can sell to the ginner or other local buyers (fig. 11). Producers who do not sell at the gin move cotton to local warehouses, retaining title. Some producers employ brokers to sell their cotton or arrange sales through commission firms. Farmer cooperatives are an important means of marketing in the major production areas of the Cotton Belt. Producer members agree in advance to deliver their crop, or a portion of their crop, to the cooperative. The cooperative is then responsible for marketing, and the net proceeds are returned to the producer.

Firms operating as cotton shippers are the primary link between the farm producers and the mill consumers of raw cotton. These firms buy baled cotton in lots of mixed qualities as near the points of growth and as soon as it enters marketing channels as practicable. This ownership transfer may involve direct purchases from producers or the exercise of forward crop contracts, and purchases from ginners, local buyers, the CCC, and from cooperatives. Shippers also buy and sell cotton among themselves to fill orders for specific qualities. In selling to domestic and foreign mills, shippers generally arrange for and pay the cost of transportation in addition to most costs and risks associated with other marketing functions and services.

About 60 percent of farm sales are handled by cotton shippers (fig. 11). Cooperatives handle about 28 percent of the crop, and sales to ginners, brokers and mill buyers, and other outlets account for the remainder.

Marketing Services and Costs

Moving cotton from farms and delivering it to consumers in the form of clothing and other textiles require the services of numerous types of intermediaries. Each stage provides additional utility and added costs to each bale.

Seed cotton handling

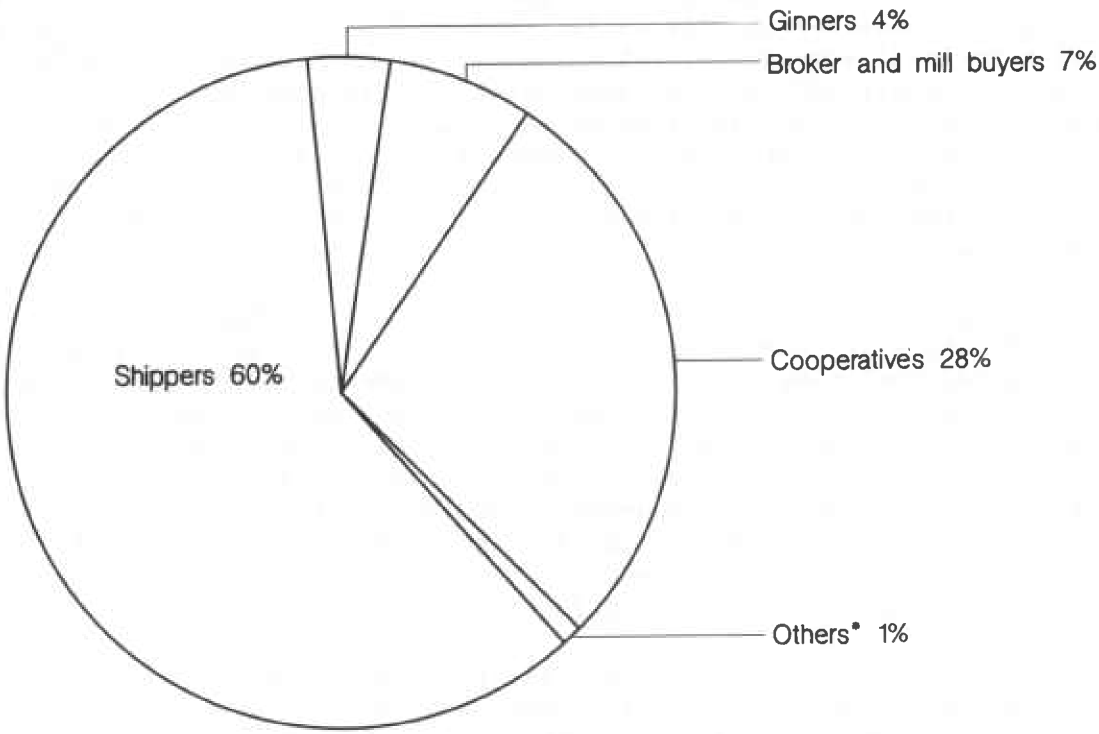
Cotton producers have historically assumed responsibility for transporting seed cotton to the gin. In some areas, however, gins have undertaken much of this function as a competitive device and may give rebates to growers who have their own trailers. Most cotton trailers carry an amount of seed cotton which yields six to eight 480-pound bales of cotton lint. A few of the newer trailers have a 10-bale capacity.

The volume of seed cotton required to produce a 480-pound net-weight bale can vary widely from year to year, between areas of growth, and especially by method of harvesting. For the 1985/86 season, about 1,515 pounds of machine-picked seed cotton were needed to yield a bale, 2,136 pounds when machine stripped, and about 2,094 pounds when machine scrapped or gleaned from the ground (table 28). While estimates are no longer available because of extremely small volumes, handpicked cotton required an average of about 1,370 pounds of seed cotton to produce a 480-pound bale of lint.

An estimated 77 percent of the 1985 crop was machine picked, 22 percent machine stripped, and the remaining 1 percent was machine scrapped. These figures compare with 58 percent machine picked, 19 percent machine stripped, 1 percent machine scrapped, and 22 percent handpicked or snapped during the 1964 season.

Figure 11

Distribution of U.S. cotton farm sales



* Direct to mill, port, or Commodity Credit Corporation.

Adequate storage and handling facilities, such as this warehouse, are essential in ensuring the efficient distribution of the cotton crop. (USDA photo)

With the adoption of mechanical harvesting of cotton, harvesting capacity has greatly exceeded ginning capacity in many areas at peak times during harvest. Therefore, trailers become backed up at gins. When available trailer space is filled, the harvesting operation is interrupted and the chance of crop damage due to adverse weather conditions increases. On the other hand, intermittent interruptions of harvest may exhaust the gin supply of seed cotton, forcing gins to shutdown until harvest can be resumed. In an effort to even out the flow of seed cotton to gins and to extend the total ginning season, the industry has tried numerous methods of seed cotton storage, including covered trailers, enclosed buildings, and wire baskets. None of these methods proved efficient as practical methods of operation. Beginning in the mid-1970's, however, attention focused on field storage of seed cotton. This type of storage involves placing loosely compressed seed cotton on the ground or on movable pallets at turn rows, covered with a tarp.

The primary methods of turn row storage are free-form standing ricks and modules. Ricked cotton requires special handling to place seed cotton in a trailer or other container for transportation to the gin. Seed cotton handled by the module method, however, involves the use of a "module maker" or compactor in which seed cotton is dumped during harvest. Large modules are produced on pallets or on the ground containing approximately 12,000-18,000 pounds of seed cotton. Modules are picked up and moved to the gin by a trailer-transporter or a truck-mounted mover that does not require a pallet.

The use of rick or module handling systems has been adopted to some extent in most cotton-producing States. Because large acreage is usually necessary to economically support such systems, widespread use is primarily concentrated in the Southwest and West. More than half of the crop is now handled by field-stored modules in these two regions.

Table 28--Seed cotton required for a 480-pound bale, by method of harvesting, 1974-85 seasons

Crop year	Machine picked	Machine stripped	Machine scrapped	Hand picked
		Pounds		
1974	1,477	2,284	2,252	1,400
1975	1,502	2,734	2,309	1,454
1976	1,483	2,239	2,088	1,354
1977	1,532	2,165	2,013	1,382
1978	1,526	2,214	1,996	1,375
1979	1,505	2,364	1,844	1,284
1980	1,520	2,801	1,917	1/
1981	1,509	2,203	2,053	1/
1982	1,518	2,263	1,901	1/
1983	1,490	2,239	1,919	1/
1984	1,517	2,271	1,857	1/
1985	1,515	2,136	2,094	1/

1/ Estimates no longer available.

Source: (6).

Throughout the Cotton Belt, about 39 percent of the 1985 harvest used modules, compared with only 18 percent 6 years earlier (table 29). Ricks are now used in only a few areas in the arid West, and the traditional use of trailers for seed cotton handling predominates in most of the Southeast and Delta.

Use of field-stored modules as a method of delivering seed cotton to gins should continue to increase, but less rapidly than in recent years. A large number of producers have disposed of their trailers and rely entirely on modules. But many producers still use trailers, employing the module system for overflows when production volumes are especially high.

Ginning

The cotton ginning sector provides the initial transformation of raw cotton into a marketable textile fiber. The critical services performed at the gin affect the quality of cotton and, therefore, its end-use value.

Processes and services. When harvested, cotton contains dirt, hulls, leaf fragments, stems, and other material which must be removed in the ginning process if lint cotton is to have the highest market value. For each 480 pounds of lint produced, approximately 520 pounds of trash (such as dirt, hulls, leaves, and stems) are separated, approximately 20 pounds of motes (very short immature fibers) are reclaimed for sale, and 780 pounds of cottonseed are produced for crushing and planting seed (fig. 12).

The cotton ginning process primarily involves six steps or stages that separate and remove these materials and prepare the lint for market. These stages are common processes in all regions of the Cotton Belt, but because of variations in production and harvesting practices, more elaborate systems are sometimes used in areas where extensive machine-stripping is practiced.

Table 29--Seed cotton handling methods, crop years

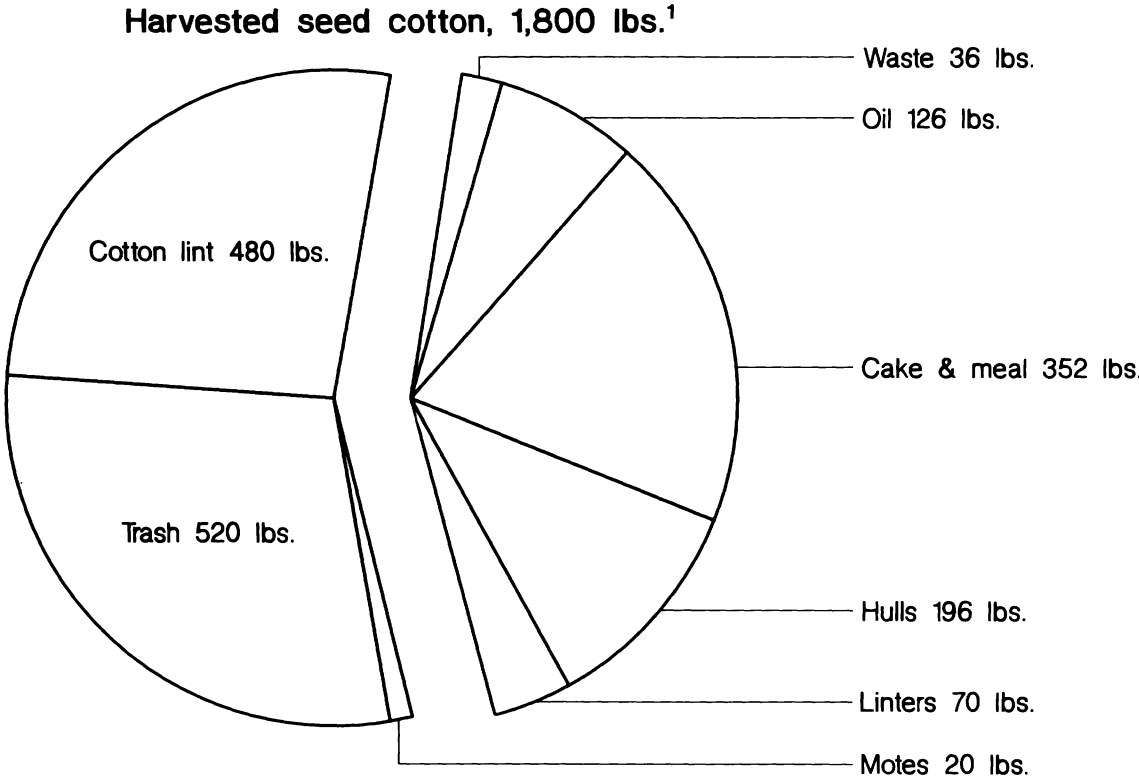
Crop year	Proportion of production handled by-- Trailers	Modules	Ricks
		Percent	
1976	91	7	2
1977	83	13	4
1978	82	18	1/
1979	73	26	1
1980	67	32	1
1981	60	39	1
1982	64	36	1/
1983	58	42	1/
1984	64	36	1/
1985	61	39	1/

1/ Less than 0.5 percent.

Source: (6).

Figure 12

Distribution of harvested seed cotton



1/ Weighted average of all methods of harvesting.

1. Drying: Drying seed cotton is the first major process in improving cotton grades and increasing ginning efficiency in excess moisture situations. Nearly all gins in the United States are equipped with one or more stages of drying. Driers condition the seed cotton for smoother and more continuous operation of the gin by removing the excess moisture and by fluffing the partly opened locks. Dried cotton gives up more of its foreign matter and the ginned lint is smoother.

2. Cleaning: The second major process in ginning is bulk cleaning. The cleaning machines remove burs, sticks, grass, stems, dirt, and sand. These machines increase the lint grade and, thus, the value of cotton, and reduce manufacturing waste to mills.

The types and amounts of cleaning equipment used vary widely throughout the Cotton Belt and are closely related to the kinds of cotton grown and the harvesting method used. Gins in the Southeast are generally older and have less elaborate overhead cleaning equipment than those in other regions. Gins in the stripper-harvest areas generally have extra cleaning equipment not usually needed in the spindle-harvested areas; thus, total investment in these areas for gin facilities is usually higher. Ginning charges also tend to be higher.

3. Extracting: The third step in seed cotton treatment is removing large particles of foreign matter by means of carding principles, whereas the cleaning process removes fine trash, leaf particles, and small parts of stems. In the extracting process, the locks of seed cotton are seized when they pass beneath a stripper or beater; burs, sticks, stems, and other large pieces of foreign matter are knocked off.

4. Separating: The actual operation of removing the cotton lint from the attached seed is performed at this stage of the ginning process. For practically all U.S. Upland cotton, the separation is accomplished by the saw-ginning method. The gin stand consists of a series of rotating saws which essentially slice the fiber from the seed. Most extra long staple (ELS) cotton, however, is processed on roller-gins. Although only a small volume of ELS cotton is produced, these facilities are designed to remove the fine, longer staple fibers by means of opposing rollers which pull the fibers from the seed.

5. Lint cleaning: The separated cotton lint moves on to the lint cleaners, while cottonseed is transported to a seed storage area. Lint cleaners are common in nearly all U.S. gins. This stage removes foreign matter from lint as a continuous process of ginning. Lint cleaners effectively remove any remaining small leaf particles, motes, green leaves, and grass left in the cotton by cleaners and extractors. Lint cleaners improve the cotton's grade, but the process reduces bale weights by as much as 50 pounds or more. The quantity of foreign matter removed varies, depending on the harvesting method, number of cleaners used, and initial trash content of cotton being ginned. Thus, in some bales, the losses in bale weight may offset the value of grade improvement.

6. Packaging: The final step in the cotton ginning process is packaging the lint into bales covered primarily with jute or woven polypropylene wrapping and secured with six to eight metal straps or bands. Cotton was traditionally compressed at the gin into "gin-flat" bale forms with a density of 12-13 pounds per cubic foot. They were later recompressed at the warehouse into "standard density" (23 pounds per cubic foot) for domestic shipments, or into "high-density" bales (32 pounds per cubic foot) for overseas shipments. Compression of bales to greater density reduces size, enabling cotton to be shipped at a more favorable transportation rate, and also decreases the volume required for warehouse storage.

Most bales are now compressed to a "universal density" of 28 pounds per cubic foot, which is the acceptable density for both domestic and foreign shipment. While most universal density compression is performed at warehouses, many cotton gins have replaced their old flat bale presses with new universal density equipment, or modified their existing equipment to accommodate the dimensions of universal density presses at warehouses. By 1984, approximately 26 percent of all U.S. gins had installed universal density bale presses, 41 percent had modified their flat bale equipment, 12 percent contained old standard or high density presses, and only 21 percent of all gins used the traditional flat bale press. Most flat bale presses, however, are located in gins in the Southeast where large gin-to-mill shipments make further compression unnecessary.

Gins may also provide other marketing services. While most bales are sampled at warehouses, gins in a few areas handsample bales in gin yards, and others have installed expensive automatic-mechanical samplers where gin volume is sufficient. Use of automatic sampling is concentrated primarily in the California-Arizona area and to some extent in Texas, where most newly contructed, high-capacity gins employ automatic samplers in conjunction with universal density compression.

Cotton gins are important collection points for USDA classification and sampling fees, and various association and industry self-help program dues. Also, many gins haul modules from fields to gins and transport bales to warehouses. Ginners in a few areas buy a substantial portion of the crop, either for their own account or as an agent for shippers. Most cottonseed is purchased through or by ginners for resale to oil mills, and some ginners sell various farm supplies in an effort to attract and hold business.

Number, Size, and Location. Cotton gins are strategically located throughout the cotton-producing States, usually in the immediate area of production. During the 1984/85 season, 1,857 U.S. cotton gins operated, with about 73 percent concentrated in the Delta and Southwest (table 30). The number of active gins has declined over the years in response to increasing operating costs, shifts in location of production, and the construction of newer, high-capacity facilities. Despite declines in number, gins today process approximately the same size of crop as in earlier years. During the 1984 season, the 1,857 active gins processed about 13 million bales, compared with 12.5 million bales by 3,281 gins during the 1973 season.

This trend toward fewer, more efficient gins should continue. However, in most areas, total capacity of gins greatly exceeds annual production requirements. Throughout the Cotton Belt, a total annual operating time of 906 hours and an average of 85 percent of rated gin capacity is generally considered an industry operating maximum. At this rate, the 1984 potential ginning capacity would total about 28 million bales, or a capacity of nearly 2.2 times larger than the 1984 volume of production.

Average gin size (as measured by rated capacity) can vary significantly by State. Approximately 29 percent of all gins were rated at eight bales per hour or less in 1984, with many of these smaller facilities concentrated in Arkansas, Mississippi, and Texas (table 31). Most of the modern, high-capacity gins of 19 bales per hour or over are located in the Western States, especially California and Arizona, and in Mississippi, Louisiana, and Arkansas. Gin size tends to become smaller, on the average, as one moves from west to east or from the newer to the older production areas.

Ginning Charges. Charges paid by cotton producers for ginning services also vary considerably by State because of differences in condition of seed cotton, method of harvest, and the kind and amount of services provided. During the 1985/86 season, ginning charges averaged $44.86 per bale, but ranged from a high of $54.26 per bale in New Mexico to a low of $36.59 in Mississippi (table 32). Machine-stripped cotton, primarily in Texas, Oklahoma, and parts of New Mexico, requires that an additional 700-800 pounds of seed cotton be ginned to yield a typical 480-pound bale, compared with machine-picked cotton. Processing this added material, in addition to the extra cleaning equipment used, increases operating costs, and hence the generally higher ginning charge. Also, actual gin operating costs are strongly influenced by prevailing wage rates, electricity charges, insurance costs, and general overhead.

Ginners use a number of methods of assessing ginning charges. Within a particular area or region, however, most ginners adopt and use the same basic method. The most common methods used to assess ginning charges are the following:

1. A charge per hundredweight of seed cotton, including the cost of bagging and ties.
2. A charge per hundredweight of seed cotton, plus a separate charge per bale for bagging and ties.
3. A charge per hundredweight of lint cotton, including the cost of bagging and ties.
4. A charge per hundredweight of lint cotton, plus a separate charge per bale for bagging and ties.
5. A flat charge per bale, including the cost of bagging and ties.
6. Ginned for the seed.

Table 30--Number and location of U.S. cotton gins, crop years

Region/State	Number of active gins in -- 1980	1981	1982	1983	1984
			Number		
Southeast:					
Alabama	110	107	96	87	91
Georgia	58	59	59	56	53
North Carolina	40	40	37	34	37
South Carolina	56	58	57	51	53
Total	264	264	249	228	234
Delta:					
Arkansas	198	175	155	138	143
Louisiana	98	96	95	92	93
Mississippi	296	283	263	247	247
Missouri	72	65	59	48	54
Tennessee	90	88	83	78	79
Total	754	707	655	603	616
Southwest:					
Oklahoma	88	87	79	78	76
New Mexico	42	42	37	33	33
Texas	762	759	672	643	629
Total	892	888	788	754	738
West:					
Arizona	120	120	112	98	100
California	223	207	192	166	169
Total	343	327	304	264	269
United States	2,253	2,186	1,996	1,849	1,857

Source: (35).

Since many cotton gins operate as farmer cooperatives, a portion of the ginning charge may be rebated to the producer. The amount of rebate given varies from gin to gin, usually depending upon the total equity available at the end of the ginning season.

Cotton Storage and Handling

The cotton warehousing system is vital to the efficient marketing of U.S. cotton. Large amounts of storage space are needed, especially during peak seasonal periods, to ensure an orderly flow of cotton to domestic mills and foreign customers. The cotton merchandising trade depends heavily on the warehouse industry for numerous services in relation to the physical handling of cotton required in the process of concentrating, distributing, and marketing.

Table 31--Distribution of U.S. cotton gins, by size, 1984/85

Region/State	Gin capacity (bales per hour)				
	1-8	9-13	14-18	19 and over	Total
	Number				
Southeast:					
Alabama	30	30	17	14	91
Georgia	15	11	21	6	53
North Carolina	16	14	4	3	37
South Carolina	17	20	11	5	53
Total	78	75	53	28	234
Delta:					
Arkansas	59	33	23	28	143
Louisiana	11	19	33	30	93
Mississippi	62	61	57	67	247
Missouri	7	21	21	5	54
Tennessee	39	21	13	6	79
Total	178	155	147	136	616
Southwest:					
Oklahoma	21	40	10	5	76
New Mexico	20	13	0	0	33
Texas	207	252	113	57	629
Total	248	305	123	62	738
West:					
Arizona	14	34	20	32	100
California	22	49	42	56	169
Total	36	83	62	88	269
United States	540	618	385	314	1,857

Source: Data obtained from unpublished industry survey.

The demand for storage and handling services and how economically these can be performed depend on a number of variables, many of which are generally beyond the control of the warehousing industry. The movement away from high cotton loan rates to deficiency payments greatly reduced Government stocks in public warehouses. Abandonment of strict acreage allotments allowed production to shift geographically. As a result of declining volumes and structural changes within the cotton industry, the total number of storage facilities has dropped nearly 50 percent, and U.S. storage capacity has dropped about 17 percent since 1970/71. Many small, inefficient warehouses have closed or have converted space for storage of general merchandise. Others have remained in business through mergers and consolidation. Nevertheless, considerable over-capacity exists in many areas.

Warehouse Functions and Services. Cotton warehouses provide four major physical functions prior to shipping bales to textile mills or export points: receiving, compressing, storing, and "outhandling" services. Not all cotton storage facilities, however, have compression equipment. Most warehouses in the Southeast do not recompress cotton before shipment to nearby textile

Table 32--Cotton ginning charges, by State, crop years

Region/State	Crop year 1981	1982	1983	1984	1985
	Dollars per bale				
Southeast:					
Alabama	31.79	33.70	36.46	36.27	37.76
Georgia	41.91	44.50	43.34	42.93	42.89
North Carolina	39.65	44.50	45.40	46.18	45.42
South Carolina	38.83	42.75	41.11	41.52	42.97
Delta:					
Arkansas	35.02	37.61	41.12	40.82	38.94
Louisiana	31.25	35.32	35.24	38.43	38.46
Mississippi	34.71	36.00	38.54	37.62	36.59
Missouri	38.40	39.99	41.90	39.49	37.39
Tennessee	31.66	33.86	39.50	39.71	38.78
Southwest:					
Oklahoma	48.83	47.35	46.35	50.15	48.57
New Mexico	48.55	47.02	49.72	51.85	54.26
Texas	46.69	49.01	50.20	52.48	50.18
West:					
Arizona	42.91	42.87	43.17	40.16	40.70
California	46.38	48.59	50.15	49.84	48.91
United States 1/	42.90	43.46	45.87	45.64	44.86

1/ Weighted average of State charges.

Source: (6).

mills. In other regions, 20-25 percent of all cotton warehouses operate without compression equipment. These facilities provide immediate storage for bales close to production areas, with compression to universal density performed later at reconcentration points. Also, special railroad provisions allow for "transit privileges" where cotton bales can be compressed in transit on the way to a mill or port. An intermediate stop is allowed in which bales are unloaded at a compress-warehouse for compression, then reloaded for final shipment.

The first warehouse function is receiving bales for storage. Upon arrival at the warehouse, bales receive a tag bearing the warehouse name and an identification number affixed to the bale. The bale is examined for fire or other unusual conditions. The bale is then moved to a scale where it is weighed by a weigher usually licensed under the Federal or State Warehouse Act. As the bale is moved forward from the scale, a sample is cut either by hand or mechanical sampler on both sides of the bale. Two subsamples weighing about 6 ounces each, half of which is removed from each side, are pulled from the bale and placed together to form the sample. A coupon from the tag initially affixed to the bale is placed with each sample, which is then wrapped in paper or placed in a plastic bag. A warehouse record is prepared at the same time showing for each bale the gin tag number, the warehouse tag number, and the weight of the bale. A negotiable warehouse receipt is then issued for each bale.

The sample and receipt are forwarded to the owner or, on request of the owner, to a USDA cotton classing office, cotton broker, or some other agency. The warehouse receipt is universally accepted as representing the bale described thereon. Likewise, in a sales transaction, the sample is accorded the same degree of validity.

Cotton merchants seldom see the actual bale of cotton which they merchandise. Therefore, the warehouse receipt is extremely important in all transactions involving each bale. Each bale is bought and sold and received as security for loans, based on the single bale negotiable warehouse receipt. In each case, the right of ownership and possession are transferred by delivery of the receipt. When the bale is shipped from the warehouse, the receipt is cancelled and returned to the warehouse, where it is maintained for a number of years as proof that delivery was made.

Warehouse compression of cotton to reduce the bales' cubical size reduces space requirements in storage and achieves economies in transportation charges over flat bales. A compressed universal density bale is typically 55 inches high, 25 inches wide, and 21-22 inches thick. Flat or modified flat bales received from gins are either compressed before being placed in storage or compressed at time of shipment. The time of compression generally depends on available warehouse space, anticipated volumes, labor requirements, and general warehouse practices.

Cotton storage is the primary service performed by warehouses. Immediately after bales are received and compressed, they are moved to specified storage areas in the warehouse. The exact location of each bale is noted on the warehouse record for inventory management. An extensive water sprinkler system is employed for fire protection, and bales are insured by the warehouse. Bales are placed into storage in a number of configurations, or patterns, depending upon the size and shape of the warehouse structure, construction and condition of the floor, type of handling equipment available, and anticipated cotton production and stock levels. The prevailing practice is to stack bales head-to-head, two or three bales high in paired rows with cross aisles. If enough space is available, or the length of storage will be short, cotton can be stored on-head in blocks one bale high.

When the cotton warehouse receives shipping orders from the owner of cotton indicating the desired date and destination, the warehouse is responsible for arranging timely shipment of that cotton. Storage charges generally cease if the cotton is not shipped within 10 days of the date ordered out.

Services performed in the outhandling operation include identifying the bales in the warehouse compartment ordered for shipment, removing the bales from stacks and setting out from storage, and transporting them to the shipping area, press room, or loading platform. This process is time consuming and costly, requiring a great amount of labor and machinery. In removing each bale from the place where it is stored, many other bales may have to be removed. Moreover, each bale must then be loaded either on a trailer train for transport or transported by lift truck to some other designated area of the warehouse. When bales reach the designated shipping area, they are segregated into lots and bale tag number, rechecked against the shipping order for accuracy, and, if correct, loaded into rail cars or onto trucks according to instructions.

Warehouses also provide other related services when required by the owner of the cotton. Those frequently requested are reconditioning, reweighing, resampling, and ranging (arranging in rows for inspection).

Reconditioning is usually performed as a result of fire or weather damage. Damaged fibers are removed and the bale placed in as good condition as possible. The weight of the bale after reconditioning is then recorded on the receipt. If reconditioning is not performed, the warehouseman must note on the bale that the bale was received in fire- or weather-damaged condition.

Bales are reweighed because of the tendency of cotton fibers to absorb and lose moisture. Successive buyers of cotton sometimes have cotton reweighed if it appears to their advantage. Weight gains may accrue in high humidity areas and lose weight when air is hot, dry, or windy.

Resampling is performed primarily in order to obtain a fresh sample for reclassification purposes. Changes, if any, in bale fiber properties can then be determined and prices negotiated on the basis of the classification.

Ranging is the process of removing bales from compartments, setting out, and arranging in rows in order that the owner or prospective buyer can visually inspect individual bales. Because of the labor and machinery input involved, these procedures are some of the most expensive handling services provided by warehouses in preparing cotton bales for market.

Number, Size, and Location. About 390 cotton warehouses with a total capacity of 16.5 million bales operated during the 1985/86 season (table 33). The largest concentration of facilities is in the Southeast with 172 warehouses, 43 percent of the total. In the Delta and Southwest, warehouse numbers total 102 and 106 facilities, respectively, or a combined total of 51 percent of all warehouses throughout the Cotton Belt. The number of cotton warehouses in the West represents only 5 percent of all such facilities, but they are generally large capacity warehouses, with high utilization rates. In contrast, most

Southeast warehouses are small with capacities of 15,000 bales or less. Total storage capacity for all warehouses in the region accounts for only 2.2 million bales, about 14 percent of the total U.S. capacity of 16.5 million bales. Average warehouse size in the Southeast reflects the wide variations in the concentration of production within the region with a significant number of facilities falling in each capacity grouping. Delta warehouses are widely dispersed throughout the region with approximately 33 percent of U.S. capacity.

After dropping rapidly during the 1970's, U.S. cotton storage capacity appears to be leveling off near the current total of around 16.5 million bales (table 34). However, the regional distribution of storage space has continued to adjust from prolonged overcapacity in some areas and increased demand for storage in other areas.

Southeast warehouse capacity has remained at about 2.3 million bales since 1980. Although this appears to be excessive in terms of annual production volumes, many warehouses are older, fully depreciated facilities that can operate at a lower capacity-utilization rate than would normally be expected. Because of their proximity to textile mills, Southeast warehouses also serve as important assembly points for an orderly flow of cotton to mill locations.

Storage capacity has continued to decline in the Delta region, but much overcapacity remains. The current capacity of Delta warehouses, 5.4 million bales, is more than double the annual production volume in the region. The installation of universal density compresses in many Delta gins has encouraged shipments of cotton directly from gins to mills or ports, further reducing the need for storage.

Since 1970, storage capacity has grown by about 1 million bales in the Southwest and 400,000 bales in the West. These two regions produce approximately 65 percent of the U.S. crop and have about 54 percent of the storage capacity. The generally larger storage volumes have improved warehouse utilization. However, wide swings in year-to-year production require that sufficient storage space be maintained for peak periods. For example, since the 1981 season, cotton production has ranged from 6.2 million bales to 2.6 million bales in the Southwest and from 5.1 million bales to 2.7 million bales in the West.

Warehouse Ownership. Cotton warehouses traditionally operate as either independent facilities in a single location, as chain warehouse firms owning two or more storage facilities in separate locations, or as cooperatives operating in either a single location or multiple locations. While individual warehouse capacity may vary from 1,000 to over 400,000 bales, chain warehouses usually operate facilities of larger average size than do independent companies.

Considerable investment is necessary to build and operate a cotton warehouse. Chain warehouses help maintain stability within the industry by being able to exercise economies of scale by spreading certain costs over more than one facility. These efficiencies include central control of such things as recordkeeping, equipment purchases, insurance coverage, and inventory management. Because of their scale of operation, chains also are often able to take advantage of the latest advances in cost-saving technologies.

In 1983/84, chain warehouses accounted for approximately 35 percent of all cotton warehouses, but they accounted for over 50 percent of the total U.S.

Table 33--Number and size of cotton warehouses, by region, 1985/86

Warehouse storage capacity (bales)	Number of warehouses 1/				
	Southeast	Delta	Southwest	West	United States
	Number				
Fewer than 5,000	64	4	0	1	69
5,000 - 15,000	65	17	15	1	98
15,001 - 25,000	11	4	5	1	21
25,001 - 50,000	18	34	32	6	90
50,001 - 100,000	8	34	25	4	71
100,001 or more	1	10	20	7	38
Total number	167	103	97	20	387
	Bales				
Total capacity 2/	2,245,300	5,385,900	6,193,800	2,643,400	16,468,400

1/ Number of warehouses with capacity falling in respective size groups.
2/ Total CCC-approved capacity of cotton warehouses in the region.

Source: Unpublished data, Agricultural Stabilization and Conservation Service, USDA.

Table 34--U.S. cotton storage capacity, by region 1/

Year beginning August 1	Southeast	Delta	Southwest	West	United States
	Million bales				
1970	4.3	8.5	5.1	2.3	20.2
1979	2.7	6.4	5.6	2.4	17.1
1980	2.3	6.1	5.8	2.9	17.1
1981	2.3	5.9	5.9	2.9	17.0
1982	2.3	5.7	6.0	2.9	16.9
1983	2.3	5.5	6.1	3.0	16.9
1984	2.3	5.4	6.1	3.0	16.8
1985	2.2	5.4	6.2	2.7	16.5

1/ Storage capacity of CCC approved warehouses.

Source: Unpublished data, Agricultural Stabilization and Conservation Service, USDA.

capacity. A total of 29 individual companies operate chain warehouses, with an average storage capacity of about 305,000 bales each.

The dominance of chain warehouses is greatest in the West, where they operate nearly 70 percent of the total storage capacity and over half of all the facilities. In the Delta and Southwest, approximately 55 percent of the regional storage capacity is in chain-owned warehouses. In contrast to other areas, the Southwest cotton warehousing industry contains a number of large, independent storage facilities which account for a significant proportion of the total storage capacity in the region. Southeast warehouses are primarily small independent facilities, with less than 8 percent of the total warehouse numbers and storage capacity controlled by chain warehouse companies.

Warehousing Charges. Charges for warehousing services vary from year to year and from area to area, with changes in the cost of providing the service and

Table 35--Number of cotton warehouses and average charge for primary service by State, 1985/86

Region/ State	Number	Average warehouse charge for -- Receiving services	Monthly storage	Universal density compression	Outhandling services
		Dollars per bale			
Southeast:					
Alabama	43	2.96	1.54	6.33	4.06
Georgia	65	2.63	1.51	1/	4.17
North Carolina	27	2.07	1.21	1/	2.50
South Carolina	32	2.11	1.29	1/	2.45
Delta:					
Arkansas	27	2.40	1.53	7.76	7.38
Louisiana	23	3.05	1.81	6.71	7.14
Mississippi	38	2.46	1.63	7.55	7.35
Missouri	6	1.50	1.50	7.60	7.07
Tennessee	9	1.09	1.50	5.95	6.60
Southwest:					
Oklahoma	5	2.00	1.32	7.10	3.70
New Mexico	6	1.68	1.53	6.85	4.50
Texas	86	2.43	1.34	7.26	3.75
West:					
Arizona	6	2/	1.90	5.80	4.20
California	14	2/	1.80	6.02	4.87
United States 3/	387	2.44	1.58	6.81	5.01

1/ Warehouse compression not performed.
2/ Separate charges customarily not made.
3/ Warehouse charges are weighted average of State charges.

Source: Unpublished data, Agricultural Stabilization and Conservation Service, USDA.

the kind and amount of services included. Warehouses in some areas may not charge for receiving cotton because of competition, tradition, or other reasons, or they may include a short period of storage at no cost to the owner if compression is performed at their facility. When bales are received from the gin already compressed to universal density by the gin, the warehouse usually pays an agreed-upon rebate to the gin. However, a compression charge is attached to the list of charges accrued against that particular bale, to be paid by the current owner of the cotton when it is shipped from the warehouse.

Average charges for the four primary cotton warehousing functions during the 1985/86 season are shown by State in table 35. The number of cotton warehouses operating in each State is also shown. Charges generally tend to be higher in the Delta States, especially for outhandling service, while lower charges in the Southeast reflect the absence of compression charges, except in Alabama. Warehouse storage charges are calculated on a monthly basis, or portion thereof. But, in most areas, storage charges stop if cotton is not shipped out within 10 days of the date requested by the owner.

The average length of storage for a typical bale depends upon the overall level of cotton stocks in relation to demand and prevailing regional structures and practices. The estimated average length of storage for cotton in each major production region varies: Southeast, 2-2.5 months; Delta, 3.5-4 months; Southwest, 3-3.5 months; and West, 2.5-3 months.

Cotton Transportation

Railroads and motortrucks are the primary means of moving cotton from gins and warehouses to domestic consumption centers and to port areas for export.

Shipment by rail can involve (1) the use of boxcars with a capacity of 150-250 bales depending on type of equipment, (2) piggyback truck trailers on flatcar shipments containing 80-85 bales per trailer or (3) containers which are used in most export movements from ports. Containers averaging 80 bales each are regularly "stuffed" at ports for ocean shipment, but a significant volume of cotton, especially from the Southwest, is shipped in containers from inland locations to the port areas. Movements by motortrucks usually involve trailer vans 40 feet or more in length carrying 80-95 bales. Flatbed trailers are also used in areas of low rainfall and short line haul distances.

U.S. Overview. In recent years, the trade patterns for U.S. cotton have shifted significantly. The increasing importance of the export market during the late 1970's was a primary factor in altering cotton flows, especially the emergence of the Far East as the major export market. The changing production patterns have caused adjustments in the location and operation of cotton marketing facilities and the demand for transportation service. Also, high interest rates and railroad deregulation have changed the means by which cotton travels to its ultimate destination.

For 1980/81 (the last year data are available), nearly 39 percent of all U.S. cotton shipments went directly to domestic textile mills located in the Southeast, compared with over half during the 1975 and 1970 seasons (table 36). The sharp drop in domestic mill shipments reflected expanded U.S. cotton exports and reduced domestic demand. Exports through the four major port areas accounted for over 52 percent of total shipments in 1980/81, up from about one-third in both previous time periods. Although the proportion of cotton moving to Atlantic and gulf coast ports has remained fairly stable, the

Pacific coast has become the leading cotton exporting center. Shipments to Pacific ports during 1980/81 represented nearly 33 percent of total cotton movements to all destinations, compared with about 15 percent of the 1975 crop and 9 percent of the 1970 crop.

The types of transportation used to move cotton have also changed rapidly. Since 1975, trucks have replaced rail as the primary transporter of U.S. cotton. Truck movements accounted for approximately 53 percent of all shipments during the 1975/76 season, increasing to almost 69 percent of the 1980 crop (table 37).

The steadily increasing proportion of cotton moving by truck has resulted from competitive truck rates, more flexible scheduling, generally shorter delivery periods of truck transportation, and efficiencies gained by containerized shipments, especially for export movement. An important competitive feature of rail transportation, however, is the transit privilege. Under the transit rate system, rail charges for cotton are based on the most direct route from origin to final destination. Intermediate stops to consolidate particular lots of cotton are allowed, lowering the total transportation bill.

Regional Patterns. The westward movement in cotton production, differences in cotton quality among regions, shifts in consumption patterns, and changing transportation rate structures have affected regional cotton transportation patterns.

Southeast cotton shipments are primarily to domestic textile mills located within the area. Over 93 percent of Southeast cotton transported in 1980/81 remained within the region. The stable distribution patterns since 1970 reflect the significant transportation cost advantages over other regions for consuming cotton grown within the region. Much of the Southeast crop can also be shipped to textile mills without further compression, either directly from the gin or from local warehouses, saving about $6.50 a bale. Trucks have hauled nearly two-thirds of all Southeast cotton shipments since 1970/71, with rail movements accounting for the remainder.

Nearly 72 percent of Delta cotton moved to Southeast mills in 1980/81. However, more of the Delta crop has moved into export channels in the last decade. In 1970/71, only about 10 percent of Delta cotton was shipped for export (including Canada), but by 1980/81 nearly 17 percent of all Delta cotton was destined for the export market. Also, for the first time, a significant portion (3.8 percent) moved to the Pacific coast for export to the Far East. Delta cotton's availability in large supply across a wide range of qualities has boosted overseas sales in recent years.

The most rapid adjustment in marketing flows in the Delta region has come in the method of transportation used. Approximately 62 percent of all regional shipments were rail movements in 1970/71, compared with about 24 percent during the 1980 season. The increased use of trucks as the primary transporter of Delta cotton reflects the strong competition of motor carriers in the region, plus problems of availability of rail cars and abandonment of numerous connecting rail lines within the area. For the 1980/81 season, over 76 percent of the Delta cotton shipments were by truck.

About 28 percent of the Southwest cotton marketed in 1980/81 was shipped to the Southeast mill area, primarily for use in coarse yarn fabrics such as denim and corduroy. Most Southwest cotton, however, moves to export markets.

Table 36--Distribution of U.S. cotton shipments by destination, selected crop years

Destination	Southeast			Delta			Southwest			West			United States		
	1970	1975	1980	1970	1975	1980	1970	1975	1980	1970	1975	1980	1970	1975	1980
	Percent														
Southeast mill area 1/	96.1	95.3	93.5	74.8	77.2	71.7	32.0	32.9	28.4	38.4	41.6	25.2	56.4	53.4	38.8
New England mills	0	.3	.2	.7	.2	.1	.7	.6	.1	.2	0	0	.5	.3	.1
Interior concentration points 2/	1.2	1.4	1.5	12.7	10.8	10.9	12.4	6.7	9.0	4.5	8.4	2.7	9.8	7.9	6.5
Canada	0	0	.1	3.3	2.3	3.5	3.3	.9	1.8	.3	.7	.7	2.4	1.2	1.6
Ports:															
Atlantic coast	.1	.9	.8	0	0	.1	.6	1.7	.1	0	0	.1	.2	.7	.1
Central gulf 3/	.1	.5	3.7	7.0	6.5	7.8	1.0	2.7	.1	.1	.2	0	3.0	2.9	1.7
West gulf 4/	0	0	0	.1	.7	1.3	49.0	47.0	42.9	1.9	2.8	4.8	17.0	17.5	17.9
Pacific coast	0	0	0	0	.7	3.8	.7	6.4	17.3	50.6	45.1	65.4	9.1	14.8	32.6
Other 5/	2.5	1.6	.2	1.4	1.6	.8	.3	1.1	.3	4.0	1.2	1.1	1.6	1.3	.7

1/ Textile mills located in North Carolina, South Carolina, Alabama, Georgia, and Virginia.
2/ Nonconsuming points from which cotton is reshipped to final destinations.
3/ Primarily port facilities at New Orleans, Mobile, and Pensacola.
4/ Port facilities in Texas.
5/ Minor destinations and unknown destinations.

Source: (7).

Shipments to Canada and ports accounted for over 62 percent of all regional movements in 1980/81, compared with about 59 percent and 55 percent during 1975/76 and 1970/71.

While the largest proportion of Southwest exports are handled through the west gulf ports (mainly Houston and Galveston), a growing and significant volume is now shipped directly to the Pacific coast. For exports to the Far East, merchants can use the "minibridge" system: Southwest cotton is preloaded into exportable containers at the point of origin, requiring no reloading, and then shipped either by rail or truck to Pacific ports. For 1980/81, about 17 percent of all Southwest marketings were "minibridge" movements.

Approximately 54 percent of the Southwest crop was transported by truck in 1980/81, compared with only 14 percent during 1970/71. This rapid shift primarily reflects the substitution of trucks for traditional rail shipments for cotton moving to west gulf ports.

In 1975/76, almost 42 percent of western cotton shipments were to the Southeast mill area. By the 1980 season, this proportion had dropped to only 25 percent, with increased export shipments to the Pacific coast accounting for most of the difference. As domestic textile mills gained experience with blending cottons of different quality characteristics, some of the premiums paid by domestic mills for western cotton have declined.

Because of the increasing share of western cotton moving to nearby ports, trucks transported about 79 percent of the 1980 crop, compared with 58 percent 5 years earlier. Although rail is the predominant mode of transportation to the Southeast mill area, trucks are also used for these long haul movements, in many cases because of shorter delivery times.

Table 37--Distribution of U.S. cotton shipments by mode of transportation, selected crop years

Region	1970	1975	1980
		Percent	
Southeast:			
Rail	35	37	34
Truck	65	63	66
Delta:			
Rail	62	46	24
Truck	38	54	76
Southwest:			
Rail	86	70	46
Truck	14	30	54
West:			
Rail	47	42	21
Truck	53	58	79
United States:			
Rail	64	47	31
Truck	36	53	69

Source: (7).

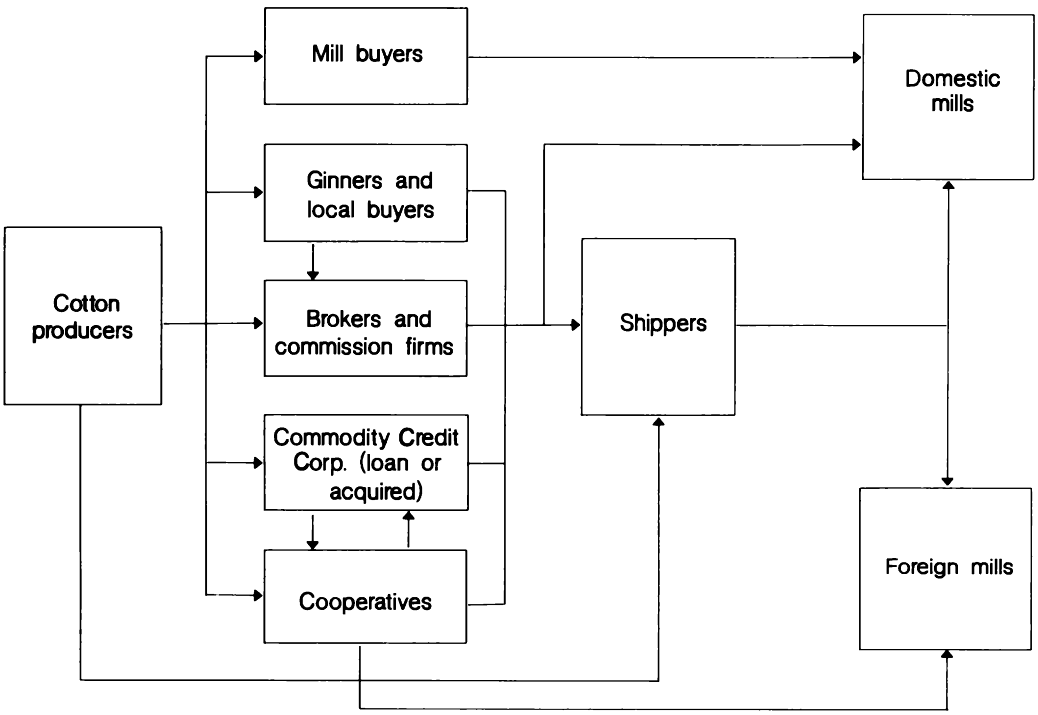
Trucks will probably continue to compete strongly with railroads for transporting cotton. Rail deregulation, high energy costs, and abandonment of some rail lines may cause more instability and wider fluctuations in transportation rates. Also, the factors altering the direction and mode of U.S. cotton shipments may continue to exert influence. The relative flows of cotton from States and regions are becoming more stable since most major adjustments in the location of production have taken place.

Cotton Merchandising

The critical link between cotton producers and final domestic and export markets is provided by various types of cotton marketing firms. These firms operate in both local farm markets and in the major central markets (fig. 13). About 90 percent of the cotton is sold by growers to the first buyer on the basis of the official USDA Smith-Doxey classification card. The rest primarily goes directly to a mill from a producer under prearranged aggreements. A very small amount of cotton remains with the ginner for use in gin "start-up" operations the following season.

Figure 13

Flow of ownership documents for merchandising U.S. cotton*



* Warehouse receipts and bills of lading.

Merchant-shippers and cooperative marketing associations handle most of each year's cotton crop, both in terms of assembling cotton from small country markets into larger volumes, and in facilitating sales to textile mills and foreign customers through contacts which have been well established over the years. Nevertheless, other types of marketing firms also play an important role in the cotton marketing process.

Methods of Operation. Private firms, referred to as merchant-shippers, perform all the functions involved with moving cotton from producers to mills. These firms take title to the cotton from the time it leaves the farmers' hands until it is sold and delivered to a domestic or foreign mill. All associated costs and risks of carrying cotton during this period are the responsibility of the merchant-shipper.

Shippers operate in all areas of the Cotton Belt, but many relatively small firms confine their operations to one area. In these latter cases, the shippers' customers are usually domestic mills that purchase all or part of their requirements from shippers located in the area involved. Many small shippers have developed grower and buying clienteles over the years. Moreover, there is always competition among these shippers for available cotton. Large shippers maintain branch offices in several areas or territories, depending on the requirements of their domestic and foreign customers. This practice occurs because most of their customers require cottons from different areas of growth and of different qualities.

Shippers who purchase from growers in the absence of a corresponding sale to a buyer immediately hedge their purchases by selling a corresponding number of bales of futures on the New York Cotton Exchange. If a textile mill sells a large order of cloth for future delivery, a purchase of equivalent raw cotton will be made from a shipper. The shipper will either buy futures as a hedge against the sale if raw cotton is not available or will make a contract with a grower to deliver cotton from the forthcoming crop. The practice of "hedging" as protection against wide price fluctuations by buying or selling futures is employed by both buyers and sellers. Generally, the shipper is not in business to "speculate" on raw cotton, and the textile firm is in business to manufacture fabrics and not to "play" the futures market. Thus, both parties offset their price risk via the futures market.

Once a sale is made by a shipper, the necessary volume is accumulated or is earmarked from already existing stocks. Terms of the contract may specify that grade and staple length be based on USDA classification card with certain micronaire specifications. However, the quality specifications will most likely be based on private type descriptions or types developed by the purchaser over the years and with which the shipper is familiar.

Also, shippers sometimes sell to one another to fill out lots for a particular order or to dispose of unwanted inventory.

Cooperative cotton marketing associations operate essentially in the same way as the merchant-shipper, except that any equity is rebated to the grower. Two major cooperatives operate their own warehouses. Approximately 28-30 percent of the U.S. cotton crop is merchandised by cooperatives each season. There are a number of small cotton cooperatives which provide only the basic service of pooling and assembling like qualities, but four major regional cooperatives account for most of cooperative volume: Calcot. Ltd., Bakersfield, CA; Plains Cotton Cooperative Association, Lubbock, TX; Southwestern Irrigated Growers

Association, El Paso, TX; and Staplcotn, Greenwood, MS. These large cooperatives are engaged in extensive fiber testing and merchandising activities. In 1971 these four jointly formed Amcot, an interregional marketing association providing its members with market information, establishing greater global coverage for their different cotton varieties, and arranging domestic or export transactions. Amcot sales offices are in both domestic and foreign textile mill centers.

Cooperatives may have several sales options available for members' use. One type of contract specifies a total number of bales with a base quality and discounts for qualities below this base. The type of contract depends upon the degree of competition and variation in lint quality existing in the forward contracting area.

Another type of sales option is a seasonal pool, designed to even out wide fluctuations in prices throughout the year. This is accomplished by blocking cotton into selected categories and fitting different qualities within the pool into sales to firms with narrow quality requirements.

A third type of sales is a call option where the grower fixes a price on a part of the crop prior to harvest. Sales are made on a fixed number of bales with price based on a base quality. Final prices are adjusted according to the contract for quality variations above or below the specified base quality.

A cotton electronic marketing system is being used by the Plains Cotton Cooperative Association. Using a computer and high speed data printers located in shippers' offices in Lubbock, Dallas, Memphis, and several other locations, information on quality and lot size is flashed on the screen for bidding. Minimum prices that producers will accept are stored in the computer for each lot and, when the asking price reaches the minimum, the computer automatically offers the lot or lots for sale. The cooperative also is involved in the bidding process, along with merchants who participate in the cities involved.

As the names imply, brokers, agents, or commission people act only as intermediaries between a grower (seller) and a purchaser (usually a shipper or textile firm) or between a seller (shipper) and a buyer (a textile firm). Minimum price is normally specified by the purchaser or seller. The intermediaries negotiate the sale and receive a commission for the volume bought or sold. They neither take title to the cotton nor perform any of the corollary functions involved in shipping, such as financing, hedging, and arranging for transportation. Their real function is the assembly of individual bales or small lots into substantial volumes of cotton for others, or in acting as selling agents in the textile manufacturing area for shippers or, possibly, large growers.

Most gin-buyers function to supplement their income. This type of operation would classify the ginners as merchant-shippers in that they take title to the cotton. Although this may be correct technically, they actually have a prearranged outlet for this volume, either to a bona fide shipper or direct to the cotton department of a textile firm.

The marketing procedure of direct mill buying from producers developed in the 1950's and 1960's, largely because of fiber quality problems encountered in the harvesting and ginning areas. A mill buyer typically would contract directly with a large grower with stipulations that the crop would be processed according to a predetermined set of conditions for a predetermined price to the grower.

Although the situation has changed over the years, there are still arrangements whereby the same firm purchases a particular grower's crop year after year. This situation is chiefly based on the confidence established between both parties to the agreement. However, this arrangement is not a general practice, for two reasons: (1) textile firm cotton departments do not have the personnel to contract with a volume of growers across the Cotton Belt, and (2) they prefer to have between them and the grower a third party who, under the present marketing system, would be the guarantor of performance under any contract dispute. Furthermore, the cost of staff maintenance, as well as personnel availability, would probably be more than the cost of doing business through a third party, who is usually a shipper. Direct contracting between mills and growers would probably become more prevalent if short supplies for particular qualities were foreseen by mills.

Marketing costs

Cotton marketing costs represent a significant part of the total price of U.S. cotton delivered to domestic and foreign customers. During recent years, costs associated with marketing have added about 7-9 cents per pound to farm prices on domestic sales, and about 12-14 cents per pound to the U.S. price of cotton delivered to foreign markets. These costs include expenses involved in assembling cotton into lots from local markets, warehouse handling and storage charges, transportation charges from storage points to final destination, insurance and financing fees, selling costs, and operating overhead and other miscellaneous expenses of marketing firms. For foreign shipments, additional expenses are incurred, such as marine insurance, wharfage, forwarding and controlling fees, and longer financing and storage periods. Table 38 shows trends in total marketing costs over 20 years.

The U.S. weighted average cost of marketing cotton to all domestic and foreign destinations combined totaled $54.10 per bale during 1983/84. This compares with $42.86 per bale in 1977/78, but was more than double the $26.98 per bale in 1972/73 season. The sharp rise resulted from increases in nearly all cost items, especially transportation and financing expenses, between the 1972/73 and 1974/75 seasons. Since 1974, however, increases in transportation costs have moderated, but costs associated with financing cotton purchases have continued to climb. The costs of warehousing services currently represent about 35 percent of the total marketing bill, compared with 26 percent in 1977/78.

The total cost of delivering cotton to foreign markets exceeds that for domestic movements, but the difference has narrowed in recent years, reflecting substantial changes in ocean rates and rate structures. The cost of shipping cotton from west coast ports to Far East markets is about 20-25 percent below prevailing rates in 1977/78.

A detailed breakdown of each major cost item involved in marketing cotton from the four production regions to domestic and foreign markets during 1983/84 is shown in table 39. Domestic outlets include textile mills concentrated in North Carolina, South Carolina, Alabama, Georgia, and a limited number of mills in New England. Primary foreign locations include Japan, Korea, Taiwan, Hong Kong, Thailand, and Europe.

Nationally, over 66 percent of the $54.10 per bale total marketing bill reflected costs for the physical warehousing and transporting of cotton. Storage, compression, and other services, such as receiving and shipping, averaged $17 per bale, 31 percent of the total cost. Transportation expenses averaged $19.19 per bale, over 35 percent of the total. Financing of cotton purchases, including hedging and bank exchange fees, is a significant and necessary cost in marketing cotton. Financing expenses for 1983/84 totaled about $8.78 per bale, with interest rates, cotton values, and length of financing primarily determining this level.

Overhead costs of marketing firms were estimated at $4.03 per bale during the 1983/84 season. Although overhead costs for a particular season may vary widely from firm to firm due to volume marketed, average overhead costs per bale show much less variation over the longer term.

The remaining cost items (buying, selling, insurance, and miscellaneous fees), although of lesser magnitude than those previously mentioned, represent vital services in obtaining cotton in mixed lots and assembling and distributing it at the time and place demanded by domestic mills or export customers.

Regional marketing costs vary because of actual differences in destinations, services performed, local market structures, and practices. For example, costs to all destinations combined varied from $23.80 per bale in the Southeast to $59.18 in the Southwest. The significantly lower cost for the Southeast resulted from the lack of foreign shipments, the close proximity of domestic mills, and lack of compression charges on most Southeast cotton.

The West had the highest cost to domestic markets ($48.80 per bale) but also the lowest average cost to foreign outlets ($58.48 per bale). Higher domestic market costs reflect the greater distance to southeastern mill points from the West. They also reflect the lower export costs which resulted from the combined effects of a larger proportionate share of shipments to the Far East, slightly lower ocean freight rates, and the cost-cutting effects of containerized shipments.

Table 38--Estimated average cost of marketing U.S. cotton to domestic and foreign outlets, selected crop years

Crop year	Market outlet: Domestic	Market outlet: Foreign	Market outlet: All outlets 1/
	Dollars per bale		
1964/65	13.56	23.24	17.14
1972/73	19.57	34.57	26.98
1974/75	24.14	55.05	38.63
1977/78	31.76	55.38	42.86
1983/84	41.95	63.23	54.10

1/ Weighted average cost to all domestic and foreign outlets.

Source: (4).

Higher buying and selling expenses, warehousing charges, and overhead costs of marketing firms contribute to the overall higher level of costs in the Southwest, compared with other regions. Longer distances from cotton production centers to port areas and generally higher ocean rates to major foreign markets also contribute substantially to the higher costs for exporting southwestern cotton.

Marketing costs from the Delta to all outlets combined averaged $46.75 per bale, well below the average for the other regions (except the Southeast). Only about 17 percent of this region's cotton is exported.

Quality Evaluation and Use in Marketing

Knowledge of cotton quality is a necessary component of an efficient marketing system. Because cotton exhibits such wide variation in fiber properties among samples, effective description and measurement of these properties are essential.

The use of quality information by textile mills enables production managers to develop optimum blending levels which reflect the best combination of fiber properties required for each end-use. For cotton producers, premiums paid for qualities most in demand and discounts for less desirable qualities provide an incentive to growers to produce those qualities that have the highest values to manufacturers and consumers of textile products.

Official Cotton Standards and Quality Measures

Grades for Upland cotton were first established in 1909 with the preparation of quality standards for nine white grades. However, these grades were never widely used and were replaced in 1914 by the U.S. Cotton Futures Act's Official Cotton Standards. These standards were revised and became binding with the U.S. Cotton Standards Act in 1923. Standards for staple length and grade standards for American Pima cotton were first established in 1918 under authority of the Futures Act (5).

The 1923 Act made use of the official standards mandatory in interstate and foreign commerce unless the cotton was sold from actual samples or private types (purchasers buy directly from farmers and conduct their own testing). The standards were soon accepted by foreign countries and were approved as universal standards by the international cotton community. The last major revisions of the standards were made in 1962. The goal of these revisions was to develop standards that are useful from a product perspective, that can be uniformly applied, and that are related to stable and measurable quality factors.

The 1937 Smith-Doxey Amendment to the Cotton Statistics and Estimates Act helped make USDA classing the most pervasive quality testing procedure in the cotton industry. With passage of this amendment, USDA began providing classing services to cotton growers at their request in an effort to motivate growers to improve quality. More than 95 percent of the cotton crop is USDA classed. Producers now pay a small fee to cover the actual cost of cotton classing, although the service was free until 1981.

Research directed at refining standards, reducing human classing errors, identifying exactly what factors describe a particular cotton, and explaining

Table 39--Estimated average cost of marketing U.S. cotton to domestic and foreign outlets by cost item and region, 1983/84 season

Cost items	Southeast			Delta			Southwest			West			United States		
	Domestic	Foreign	All	Domestic	Foreign	All	Domestic	Foreign	All	Domestic	Foreign	All	Domestic	Foreign	All
	Dollars per bale														
Buying and local delivery	1.12	---	1.12	1.50	1.61	1.52	2.20	2.30	2.27	1.72	1.79	1.77	1.71	1.99	1.87
Warehousing services:															
Storage	2.80	---	2.80	3.08	3.84	3.23	2.65	3.30	3.07	3.43	4.25	4.05	2.98	3.83	3.46
Compression	---	---	---	7.50	7.50	7.50	7.08	7.11	7.10	6.01	6.08	6.06	6.97	6.61	6.80
Other	3.95	---	3.95	7.08	9.38	7.54	3.51	7.20	5.91	4.91	8.40	7.53	5.12	7.97	6.74
Transportation	4.40	---	4.40	8.12	30.74	12.65	12.98	29.10	23.45	18.75	20.95	20.40	11.43	25.05	19.19
Cotton insurance	.15	---	.15	.21	1.70	.51	.522	.04	1.51	.63	1.94	1.62	.39	1.97	1.29
Financing	7.55	---	7.55	8.24	9.93	8.58	7.43	9.15	8.55	7.97	9.73	9.29	7.84	9.50	8.78
Selling	.76	---	.76	1.08	1.28	1.12	1.50	2.08	1.87	1.29	.93	1.02	1.21	1.43	1.34
Miscellaneous	.28	---	.28	.90	.94	.91	.53	.65	.61	.45	.50	.49	.61	.60	.60
Overhead	2.79	---	2.79	3.18	3.22	3.19	4.75	4.90	4.84	3.64	3.91	3.84	3.69	4.28	4.03
Total	23.80	---	23.80	40.89	70.14	46.75	43.15	67.83	59.18	48.80	58.48	56.06	41.95	63.23	54.10

--- = No warehouse compression performed and no reported marketings.

Source: Unpublished data, Economic Research Service, USDA.

why that cotton performs the way it does has resulted in refinement of existing standards, creation of new standards, and the invention of instruments that help determine grade, staple, and character of cotton.

Official USDA cotton quality classifications measure three factors: grade, staple, and micronaire. Grade depends on the color, trash content, and preparation (smoothness) of the sample. Staple is the average length of the individual fibers. Micronaire is a measure of fiber fineness and maturity. However, other fiber properties are also recognized as being important and are increasingly being measured by instrument testing.

Grade. Grade is determined on the basis of color, trash content, and preparation. There are 44 Upland cotton grades. A physical standard (practical form) composed of 12 samples is available for each of 15 grades for visual grade evaluation. Descriptive standards that refer to the physical standards are used for the remaining 29 grades. Color, leaf content, and the ginning process for American Pima cotton require different grade standards.

Color: Cotton is normally white, but it can become spotted or assume various shades of yellow and gray, deepening in color with age and exposure to weather. Deviation from the normal white color is considered grade deterioration. Color tests evaluate brilliance, or reflectance and hue, with some chroma differences being permitted within a grade.

Trash: Grade also depends on trash, the quantity and appearance of foreign matter remaining in cotton lint after ginning. Foreign matter includes seed, stem, leaf, bract, dirt, grass, bark, and particles introduced by harvesting equipment (such as oil and rubber) and handling (such as bagging and rope). Differences in trash content can determine color differences within a given grade.

Preparation: This is the effect ginning has on smoothness of the cotton lint. Machine harvesting, excessive gin drying and cleaning, and high gin production rates can lead to rougher lint. Naps and neps contribute to roughness. Naps are large, tangled masses of fibers that often result from ginning wet cotton. Neps are smaller snarled clusters of fibers that look like dots in the lint and are more difficult to remove.

Staple. In most cotton, fibers range from less than 1/16 inch to more than 1-3/4 inches. Thirty-one official standards exist for U.S. cotton staple. The standard intervals range from less than 13/16 inches to 1-3/4 inches, and are expressed in 1/32-inch increments. Staple usually refers to the length determination of the classer, while the term length indicates an instrument measure. The former is expressed in 1/32 inch and the latter is measured in 1/100 inch. The staple of about 65 percent of U.S. cotton has been 1-1/16 inch or longer since the 1982 season.

Character. The character of cotton is determined by identifying and measuring a number of other important fiber properties:

Fineness and maturity: Fineness and maturity may be measured independently or together. The airflow instrument most commonly used to test them gives one value, the micronaire reading, for their combined effect. A cotton fiber has a cross section like a pipe, it is hollow with inside and outside diameters. For Upland cotton, the outside diameter is approximately the same for all fibers, at 15 microns. Fineness and maturity, then, relate to the inside diameter. Fineness is weight per unit of length, and maturity is the extent of cell wall development. Fineness is a characteristic of variety, so different values for a given variety indicate maturity differences. Similarly, fully mature fibers from different varieties may differ in micronaire due to fineness differences. Micronaire readings range from about 2.4 to 7.5, with each cotton sample containing individual fibers carrying values throughout this range. The overall micronaire reading depends on the proportions of values represented in the sample. A micronaire reading below 3.0 is considered coarse; 3.5 to 4.9 is most desirable for Upland cotton varieties.

Strength: Fiber strength contibutes to the yarn and fabric strength and is a measure of the force required to break a sample of fibers. The measures are reported in 1,000 lbs. of pull per square inch or in grams per tex. Increased speeds in modern textile spinning and weaving machinery are placing increased importance on fiber strength as a measure of cotton quality.

Length uniformity: Although staple gives an indication of average fiber length, it does not provide information on the proportions of various fiber lengths constituting the cotton sample. Measures of length uniformity describe the distribution of the fiber lengths in the sample.

Elongation: Elongation is the extent to which a fiber may be stretched and is usually tested as part of a strength test expressed in percentage terms. Fiber elongation is related to yarn elongation which helps to withstand the stresses of the weaving process without breakage.

Stickiness: Manufacturing problems may occur if cotton fibers stick to equipment because of farm chemical sprays, oils, plant and insect sugar (secretions from insects), or fiber immaturity. One test used to indicate potential stickiness is a measurement of the sugar content of the cotton sample. Processing problems usually occur when the sugar content exceeds 0.3 percent.

Nep count: Although neps may be considered part of preparation, they are related to other fiber properties and have a separate test. Nep formation during harvesting, ginning, and processing increases as fiber length, fineness, and immaturity increase. Neps are measured by processing a cotton sample into a web and counting neps per unit of area.

Moisture content: Moisture levels are frequently determined by weighing the fiber before and after drying. Moisture is reported as a percentage of the weight of the predried specimen. Some instruments use a current flow method to determine moisture content. Controlling moisture is also important for accurately measuring other fiber properties.

Sampling and Classification Process

Quality testing traditionally has been based on human inspection. With the introduction of the official standards, visual quality determination was aided by the development of practical forms. For grade determination, a practical form is a number of boxes, each containing samples of the same grade. A classer then grades the samples by comparing cotton to be classed with the practical forms. For staple length determination, a practical form is 1 pound of cotton of a given staple length. A classer may then compare cotton to be classed with some pulled from the comparable staple length form, using both sight and touch.

Most samples are collected at the warehouse, the first point for sampling. Some gins have mechanical samplers which collect samples during the ginning process. But, such samples constitute only a very small portion of samples classed. At the gin or warehouse, the bale is tagged with identification and is cut on both sides (mechanically or by hand). The two cuttings are combined to form a sample which is identified, packaged, and sent to the bale owner or a designated place for classification. The usual destination is one of 20 USDA marketing services offices. The offices which provide cotton classing services are centrally located throughout the Cotton Belt.

Cotton classification, or classing, has traditionally been accomplished by describing its quality through visual examination of the sample to determine its grade and staple length, and by the use of an airflow instrument to estimate fineness and maturity by the micronaire value.

Once a sample has been classified, values are stamped on the classification (or green) card which accompanies the sample to the classing office. The classing office returns the completed card to the gin, which in turn delivers it to the producer. If, however, a previous sale or other arrangement has been made, the classing office may turn the card over to a merchant, marketing association, or a trucker upon written authorization of the producer.

In recent years, USDA and private industry have sought to develop and use instruments as an integral part of the USDA classification process. A high volume instrument (HVI) testing system was first employed in a classing office environment at the Lamesa, TX, USDA classing office for the 1980 season. Approximately 300,000 samples were classed under the HVI system, representing a first move from primary emphasis on humans in the USDA classification system to emphasis on instruments.

Instrument test values measure color, fiber length, fiber fineness and maturity (micronaire), length uniformity, and strength. Trash content is visually determined, and a grade index is recorded on the class card along with the other test measures.

Since 1980, USDA has rapidly expanded the availability of the HVI system. During the 1984/85 season, HVI testing was available in 15 of the 20 AMS marketing services offices. At a producer's request, HVI values are supplied in addition to the standard Smith-Doxey classification. The fee for HVI service was 45 cents per bale during 1984/85, compared with $1.05 per bale for conventional classing. Approximately one-third of the total cotton crop was HVI tested in each of the past three seasons.

Quality Measures and Relationships to Marketing

Each sector of the cotton industry receives significant benefits from the present system of measuring and reporting cotton quality. Cotton producers use green card values as a check on production and harvesting methods. The values also help in determining relative quality so the farmer may expect premiums or discounts, if applicable, for the marketed quality. For the ginner, the green card measures may be useful as a check on ginning methods. Green card and other quality measures permit the merchant to assemble bales into even-running lots (large numbers of bales of like quality) and satisfy mill specifications.

Quality measures are also used in forward contracts and on organized exchanges, in addition to uses in the usual farmer-to-merchant-to-mill marketing chain and in direct farmer-to-mill sales. Forward contracts, which are signed prior to harvest, call for the farmer to place a quantity of cotton or production from certain acreage under contract. A single price may be set for all cotton meeting some minimum quality--a "hog-round" contract--or the price may depend on quality deviations from a base quality, a grade and staple contract. Futures contracts, such as those on the New York Cotton Exchange, specify within narrow limits the quality acceptable for delivery. Information on quality, despite its addition to marketing costs, is essential for efficient operation of all of these alternative marketing arrangements.

For textile mills, different end-use requirements, such as yarn strength and yarn and fabric appearance, require different fiber qualities. The ability of a fabric to hold dyes, as well as recently developed finishes such as shrink resistance, flame retardance, and durable press, depends on fiber qualities. For given product requirements or spinning characteristics, a textile producer may not be able to obtain all the raw fiber qualities needed when buying a particular genetic cotton type from a given location. Quality of a cotton variety can vary from farmer to farmer and vary tremendously from year to year. In such instances, quality measures become the basis for a recipe of sorts; the textile producer blends, or lays down, mixes of various types of cotton to obtain a specific quantity of cotton with the required quality measures.

Some properties, such as trash or length uniformity, also affect cost of production, as well as spindle speed, end breakage, or losses due to waste. Staple or fineness and maturity affect yarn and fabric quality such as appearance, strength, and fabric feel.

The growth in more stringent standards for end-product quality, as dictated by consumers, has been an important element in establishing the relationships among classes of cotton, spinning performance, and product quality. Technological advances in textile production have sharpened the importance of the relationships between processing costs and fiber quality.

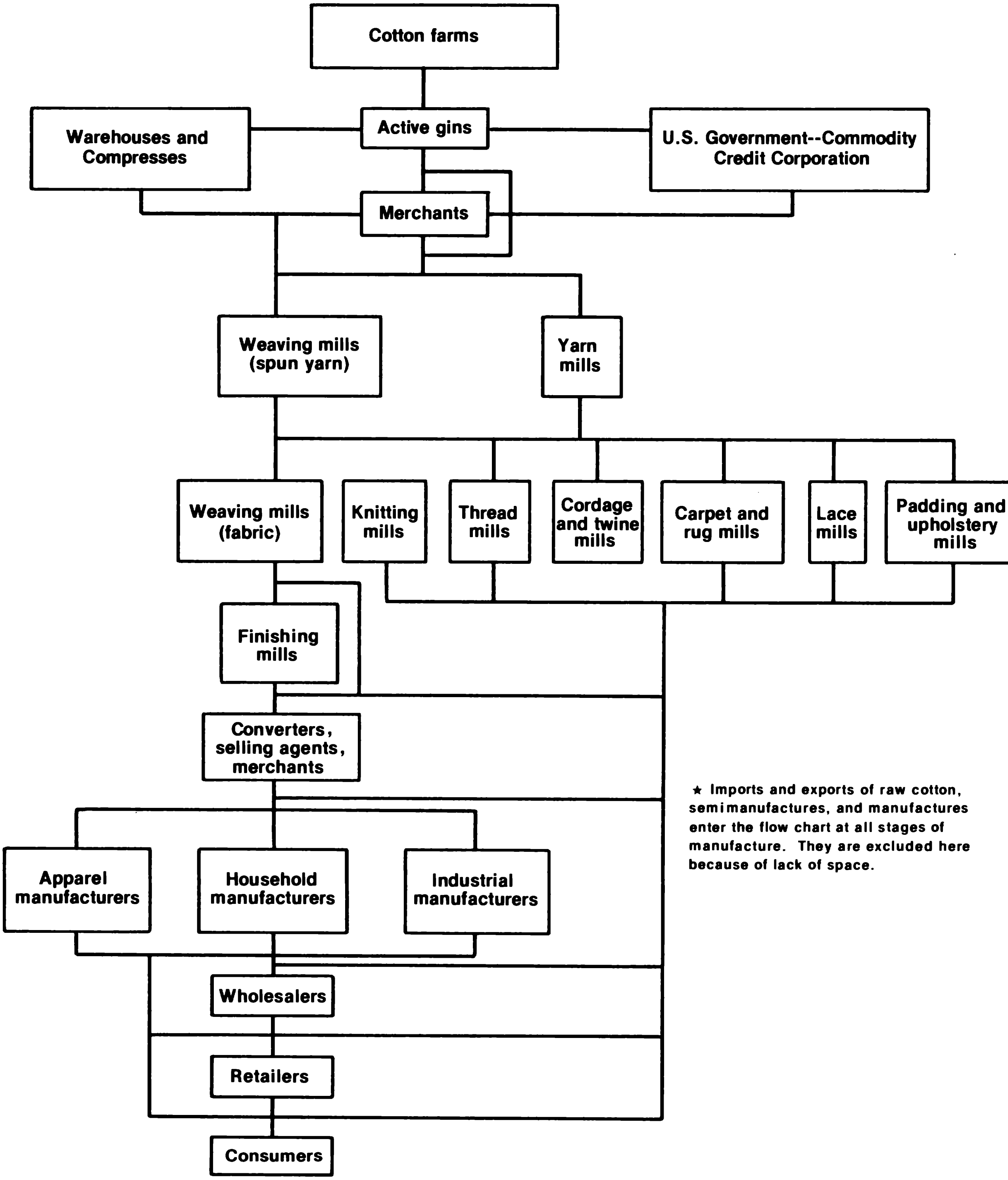
Poor quality fiber results in higher waste levels, increased ends down (interruptions in the yarn formation process), and more seconds in finishing operations. Manufacturers must have detailed fiber quality information to keep pace with ever-increasing processing speeds and to assess the potential for cost-cutting innovations which increase the competitive position of the U.S. textile industry.

TEXTILE AND APPAREL MANUFACTURING

The textile and apparel industries transform raw fiber into finished consumer and industrial products (fig. 14). These industries represent one of the largest sectors of the U.S. economy, providing employment for millions of people, with a combined payroll exceeding $20 billion in 1982. Consumer purchases of apparel totaled $118 billion during 1984, about 14 percent of all nondurable goods expenditures. In addition, the estimated retail value of the raw fiber contained in house furnishings and industrial products reached nearly $52 billion in 1984.

Figure 14

U.S. cotton industry flow chart *



★ Imports and exports of raw cotton, semimanufactures, and manufactures enter the flow chart at all stages of manufacture. They are excluded here because of lack of space.

The textile industry consumes about 11-12 billion pounds of raw fiber annually, which is processed into about 21 billion square yards of fabric. Nearly 16 billion square yards are broadwoven fabrics, and about 5 billion equivalent square yards go into knitted fabrics, carpets, industrial applications, and other products.

Cotton was the major fiber used in U.S. textile production until 1967, when cottons' share of total fiber use fell below 50 percent for the first time. Today, manmade fibers represent about 74 percent of all fibers consumed in U.S. mills, and cotton accounts for about 25 percent, while wool use has remained at 1 percent for a number of years.

U.S. per capita fiber consumption was about 55.3 pounds in 1984, which includes products produced by U.S. mills in addition to the raw fiber content of imported textiles. Consumption of manmade fibers was 37.3 pounds; cotton, 16.6 pounds; and wool, 1.4 pounds.

The Fiber-to-Fabric Process

The mechanical processes of turning individual fibers into finished cloth or fabric involves numerous complex machines and manufacturing operations. A 1-pound sample of raw cotton contains about 100 million separate fibers which must be arranged in such a manner as to create a usable product.

A listing of the primary cotton quality factors, and how they affect textile mill processing characteristics is shown below.

Quality factor	Processing characteristic affected
Grade:	
Color	Dyeing, bleaching.
Trash	Processing waste, textile machinery contamination, product appearance, cotton dust levels.
Preparation	Processing waste, product appearance.
Staple	Yarn and fabric fineness and strength, nep formation during processing.
Character:	
Fineness and maturity	Nep formation during processing, yarn and fabric strength, product appearance, processing waste, ends down.
Length uniformity	Processing waste, ends down.
Strength	Yarn and fabric strength, ends down.

The first step in this process begins with the arrival of the fiber in the opening room of the textile mill. Cotton from a number of bales is blended together and separated into large tufts. The blending and mixing of bales with known fiber properties is necessary to maintain uniform processing performance and yarn quality. The number of bales used in a mix depends on the amount of detailed knowledge of the fiber properties of each bale and on the type of product to be manufactured. Between 6 and 12 bales are typically mixed, but the number can run to more than 50 bales in some applications.

After leaving the blending machines, the large tufts of cotton pass through cleaning equipment where they are reduced in size and fluffed, and quantities of trash (such as stems, leaf, and seed coat fragments) are removed. The next step is the picking operation where trash removal continues and small tufts are formed into a continuous sheet known as a "picker lap." The picker lap is then fed into carding machines. Carding is the most important process in yarn manufacturing. The small tufts of fiber are worked into a high degree of separation or openness, most of the remaining trash is removed, and the fibers are then collected into a rope-like form called "card sliver." The sliver is coiled in large drums for further processing.

Approximately 85-90 percent of all cotton yarn produced in the United States is carded yarn. The remainder is processed as combed yarn which involves a much higher degree of cleaning and fiber preparation. Combing machines remove most of the short fibers and some poorly formed longer fibers. This material, called "noils," has resale value for use in coarse cotton yarn, nonwoven products, and some industrial uses.

Drawing and roving are the last processes before the final yarn formation on the spinning frame. The drawing operation uses a system of rollers drawing out the slivers and making the fibers parallel. This process evens fibers by merging as many as eight individual slivers into one strand about the width of a thick rope. The roving process further reduces the weight per unit length of the sliver to a suitable size for spinning into yarn, and twists the fibers together to maintain integrity of the strand. Only enough twist is required to impart sufficient strength to the strand so it can be pulled from the bobbin during the spinning without breaking. Fiber length or staple is very important at this stage. Longer, finer cotton requires less twist in roving and spinning than shorter, coarser cottons for equivalent yarn strength.

Spinning is the most expensive single process in converting fiber into yarn. Because of the high cost of yarn production, and the critical relationships between fiber properties, yarn quality, and end-product performance, considerable research efforts have been directed towards increasing the economic efficiency of this operation.

Two primary methods of yarn spinning are used by textile firms throughout the world: ring spinning and open-end spinning. Approximately 80-85 percent of cotton yarn is produced by ring spinning, and 15-20 percent by the open-end process. New technologies employing advanced methods of yarn formation, such as air jet spinning, are being tested. These techniques may result in a wide selection of spinning methods which are tied directly to the type and style of end-product to be produced.

The traditional ring spinning process involves passing roving yarn through rollers of the spinning frame where the strands are twisted 10-30 times per inch to form a strong yarn. The yarn is then wound onto conical, foot-long bobbins. Yarn produced by this method varies from the coarsest yarns for such products as mops and ropes, to the finest yarns for use in specialty fabrics such as ribbons and fine apparel. Improvements in ring spinning technology over the years have greatly increased processing speeds and yarn quality and have significantly reduced labor requirements. Current ring spinning equipment operates at approximately 10,000-20,000 revolutions per minute, more than double the speeds 20 years ago.

Open-end spinning eliminates the roving process, and sometimes one drawing operation, resulting in lower processing costs and shorter manufacturing runs. With speeds of 60,000 revolutions per minute, the production rate of open-end equipment is significantly higher than for ring spinning. To produce open-end spun yarn, drawing sliver is pulled into the system, where a small opening roller with wire teeth pulls off individual fibers, then into an airstream, and finally into a rapidly spinning rotor. Fibers are deposited on the perimeter of the rotor where they are evenly distributed in a small groove. Then, using a started yarn, the rotor with a spinning action twists the fibers together. Yarn from open-end spinning is much more uniform than ring-spun yarn, but it is considerably weaker and has a harsher feel. Its properties are well suited for heavier fabrics such as denim, velveteens, and corduroy. Cotton with low micronaire (coarse fibers) and high fiber strength are best suited for open-end spinning.

Before yarn can be processed into fabric, an additional step is usually performed. Yarn is transferred from bobbins onto packages of yarn called cones by high-speed winding machines (winders). This operation cannot be economically produced at the time of spinning. Also, depending on end-use and properties desired, yarns may be plied after winding which involves the twisting together of two or more single yarns. Plied yarns are more uniform and stronger than single yarns and have better abrasion resistance. These plied yarns are used primarily in fine apparel and industrial fabrics.

Weaving and knitting are the two primary methods of transforming yarn into fabric. Weaving is a process in which lengthwise (warp) yarns are interlaced with crosswise (filling) yarns. Weaving is performed on a loom. Warp yarn is fed to the loom from a beam, a cylindrical object shaped like a spool containing thousands of yarns. Filling yarn is inserted by passing a shuttle containing a bobbin of yarn through the warp yarns. Other methods of filling insertion include use of rapiers or jets of air to propel the filling yarn. The cycle is repeated continuously to form a fabric. Each cycle is called a pick.

The weaving industry is in a state of change. Technology has advanced rapidly in recent years, making possible significant increases in weaving speeds. Looms typically have been capable of producing fabric at nominal rates of 300 picks per minute. Modern high technology looms are now capable of almost twice this rate. These faster speeds and higher production rates place added stress on yarn quality and, consequently, fiber property requirements are affected. Yarns used in high speed weaving must be stronger and more uniform than yarns formerly used. These demands for improved strength and uniformity have magnified the need for instrument measurements in the marketing and utilization of cotton.

Preparation of yarn for knitting is relatively simple compared with that required for weaving. Fabric can be knitted directly from cones of good quality yarn without any preparation other than application of wax or lubricant to help reduce fly (airborne fiber particles) and to facilitate movement through thread guides and devices for maintaining uniform tension as the yarn is fed in the machine.

Knitting is performed by forming loops with a single, continuous yarn and joining each loop to its neighbors to form a fabric. The loops of a knitted fabric form a series of chains, called "wales," running lengthwise in the fabric. The loops also form lines, called "courses," at right angles to the wales. Wales and courses in knitted fabric are equivalent terms to warp and filling in woven fabrics. Knitted fabrics can be either warp knit or weft knit. In weft knit fabrics, the yarns forming the loops generally run crosswise in the fabric. In warp knits, the yarns run lengthwise. Knitting machines may be either circular or flat. Flat knitting machines have needles arranged in one plane or in two planes at right angles to each other. Flat knitting machines may produce either flat or tubular fabrics. Circular machines have one or two sets of needles arranged in a circle and produce tubular fabrics.

Nonwoven fabrics are manufactured by chemically or mechnically bonding individual fibers to form a mat or web. Numerous methods and adhesives are used to complete the nonwoven structure. Typical nonwoven products include disposable clothing, medical supplies, filters, and wiping cloths. Most types of manmade fibers, cotton, and wool are used in nonwoven products. Cotton is the primary fiber for nonwoven applications where absorbancy is needed.

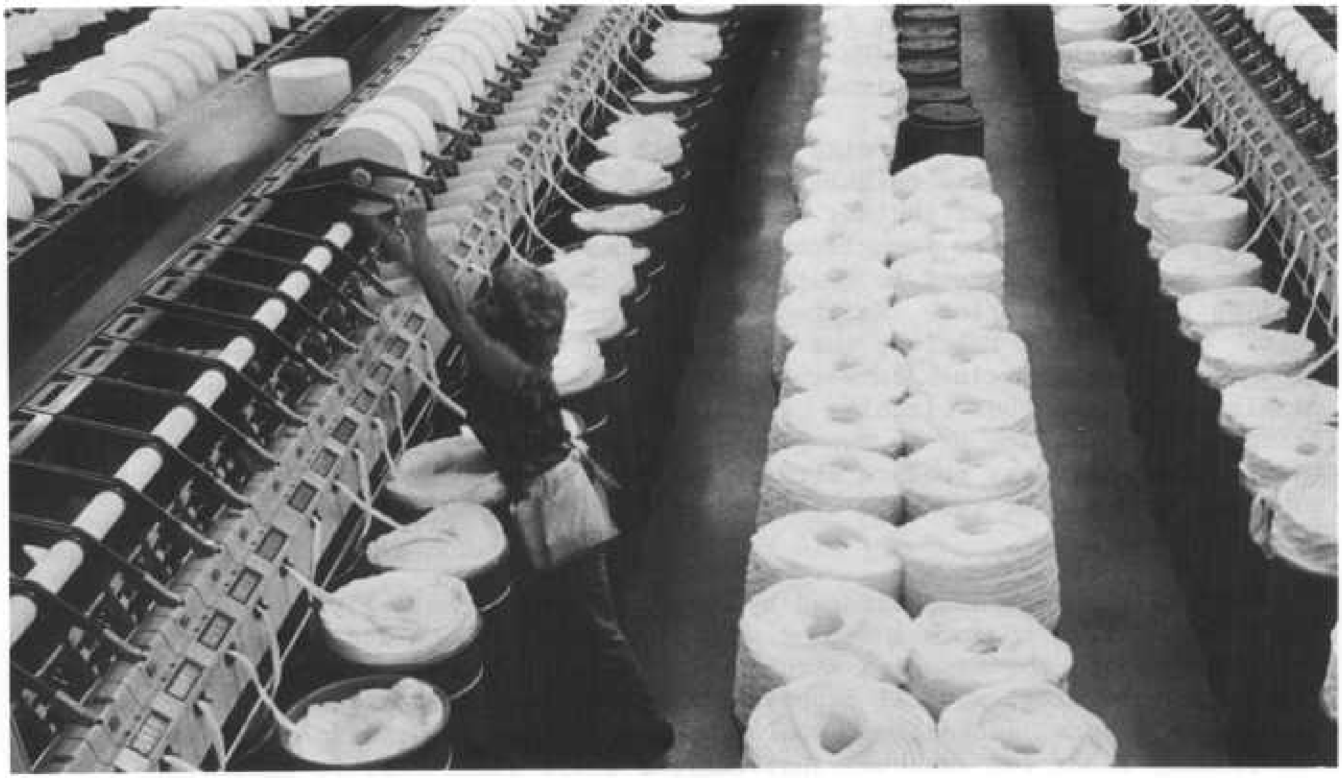
Fabric finishing is the final step in the textile manufacturing process. Some fabrics (called "gray cloth"), such as that used in bagging, are ready for fabrication when they come from the loom. All other fabrics are finished in various ways. These finishing steps include bleaching, dyeing, and Sanforizing to prevent shrinking. Sometimes packages of yarn are dyed in vats before the yarn is made into fabric (called "yarn dyed cloth").

Color is added to fabric by dyeing the yarn before it becomes cloth, or the gray cloth is passed through a continuous dyeing range to add solid colors. Jet-dyeing techniques have substantially speeded this process. There are also other forms of dyeing. When the fabric's end-use, such as sheets or blouses, calls for a design, the cloth is printed on one side only. This is done by roller printing or screen printing. Improved technology permits printing up to 12 colors on fabric at speeds of 150 yards per minute. Designs are also added to fabric through heat-transfer printing, a sophisticated version using an electric hand iron. In the finishing process, some of the special qualities of fabric are added. These include durable press, water repellency, and resistance to flame and soil.

After finishing, the fabric is shipped to manufacturers who fabricate apparel, home furnishings, other consumer products, and industrial products. A small portion of yarn, gray cloth, and finished fabric is exported without further processing. During 1985, approximately 3.5 percent of total U.S. mill consumption of cotton was accounted for by cotton contained in exported semimanufactured products.

Textile Manufacturing Industries

Firms that spin yarn, weave, knit, and finish fabric, and produce other miscellaneous textiles are classified by the U.S. Office of Management and



Open-end spinning, above, takes sliver directly from drawing. The sliver is drawn from the cans into the machines where the fibers are fed by an airstream into a turbine. Centrifugal force collects the fibers in the size of yarn desired. The yarn is then twisted and wound onto spools. These machines can produce 48-96 feet of yarn from 1 foot of sliver. (American Textile Manufacturers Institute photo)

Two widths of fabric are woven at the same time on a 153-inch-wide projectile weaving machine, below. A small metal device, traveling at high speed, carries the filling yarn through the warp. The warp beam in the foreground is feeding thousands of strands of yarn into the machine. (American Textile Manufacturers Institute photo)

Budget in the Standard Industrial Classification (SIC) Group 22, Textile Mill Products (37).

Number and Location of Plants

In 1982 (latest year available), 5,817 companies operated about 6,630 textile mills (table 40). Since 1977, however, mill closings, mergers, and consolidations have reduced the number of plants by 15 percent and the number of companies by 2 percent. The largest declines in plant numbers have been in the knitting industry, especially in circular knit fabric mills, and in producers of miscellaneous textile goods, such as padding and upholstery filling and lace goods. Growing consumer and industrial demand for new and innovative products, however, has increased the number of firms dyeing and finishing textiles and the production of nonwoven fabrics.

A major migration of the textile industry from New England to the South started in the 1920's. Lower taxes, plentiful labor supplies, adequate water power, and closeness to raw materials were factors contributing to this shift. Today, the textile mill products industry is concentrated primarily in the South, especially Alabama, Georgia, North Carolina, and South Carolina. Of the 377 U.S. yarn mills in 1982, 289 were in these States, and about 58 percent of these were in North Carolina. Many of the largest textile firms in the United States are located in North Carolina and South Carolina. In 1982, almost 45 percent of all U.S. weaving mills were located in the Carolinas, providing about 60 percent of total employment in the fabric weaving industry.

Table 40--Textile mill products industries: Number of companies and establishments

Industry 1/	Companies		Establishments	
	1977	1982	1977	1982
	Number			
Yarn and thread mills	575	500	798	714
Cotton-weaving mills	211	212	314	269
Manmade fiber-weaving mills	267	340	449	522
Wool-weaving mills	154	116	165	131
Narrow-fabric mills	291	241	335	281
Knitting mills	2,409	2,161	2,617	2,334
Dyeing and finishing plants	619	708	678	753
Floor-covering mills	541	462	592	506
Miscellaneous textile mills	1,160	1,077	1,846	1,102
Total	6,227	5,817	7,794	6,630

1/ Three-digit, SIC industry groups as defined by the Standard Industrial Classification Manual, 1972 (37).

Source: (32).

Movement to the South has been much less marked for the knitting industry than for the spinning and weaving industries. Except for the production of hosiery, the knitting of fabric and apparel continues to be concentrated in the Middle Atlantic States. For example, according to the Bureau of the Census, 56 percent of all knitting mills were located in the Middle Atlantic region in 1977, compared with about 52 percent in 1982. Pennsylvania and New York contained a combined total of approximately 45 percent of the U.S. knitting industry in 1982.

Most textile finishing plants do not take title to the cloth they process, but perform these services on order for others. Firms known as converters purchase gray cloth and move it through finishing plants for sale to manufacturers of apparel, household products, and industrial products. Converters and finishing plants, therefore, tend to be located near their primary market outlets. In 1982, about 40 percent of the textile finishing operations were located in New England and the Middle Atlantic States. The remainder of the finishing plants were scattered throughout the Southeast, in addition to 7 percent located in California, servicing a growing apparel industry.

Employment and Earnings

The textile mill products industries employed approximately 717,900 people in 1982. With a total payroll of $9.1 billion, textile mills are a significant economic factor in many areas of the United States. Weaving mills generally employ the largest number of workers, accounting for about 35 percent of all jobs in the industry during 1982 (table 41). Knitting mills, because of their large numbers, represent approximately 29 percent of all employment, but are generally smaller mills with an average of about 88 employees per establishment, compared with an average of 152 employees for yarn mills and 206 employees for the average weaving mill.

Table 41--Textile mill products industry employment and earnings

Industry 1/	Employment		Payroll	
	1977	1982	1977	1982
	Thousands		Million dollars	
Yarn and thread mills	140.4	108.6	1,184.4	1,277.7
Cotton-weaving mills	117.2	76.9	1,046.8	964.6
Manmade fiber-weaving mills	151.0	140.8	1,428.7	1,814.4
Wool-weaving mills	14.6	13.1	136.6	175.8
Narrow-fabric mills	20.8	17.5	171.6	215.5
Knitting mills	235.9	204.9	1,911.0	2,327.1
Dyeing and finishing plants	72.1	58.0	739.9	833.9
Floor-covering mills	55.8	42.3	556.6	609.5
Miscellaneous textiles	67.8	55.8	705.6	832.9
Total	875.6	717.9	7,881.2	9,051.4

1/ Three-digit SIC industry groups as defined by the Standard Industrial Classification Manual, 1972 (37).

Source: (32).

Textile mill employment grew throughout the 1960's, reflecting expanding industrial production and U.S. economic activity. During the mid-1970's, however, total employment declined, but the average number of employees per mill increased as mills became fewer but larger. Both total textile employment and the average number of employees per mill have declined. A growing volume of U.S. textile imports reduced the demand for American-made products. In an effort to remain competitive, U.S. mills have rapidly adopted numerous labor-saving innovations.

Total wages and salaries paid in the textile mill products industries have continued to increase over the years despite declining employment and mill numbers. Inflation has been one factor in higher wages but more important is the nature of the workforce itself. Greater emphasis on automation and the adoption of new technology in mills have increased the demand for more highly skilled workers, including textile school graduates. Also, increased competition for skilled labor between textile and nontextile employers in many areas of the South has tended to increase the overall level of wages.

Integration of Production

Many textile firms have combined (vertically integrated) two or more stages in the manufacture and distribution of products under one management. These stages may include (1) spinning and weaving; (2) weaving and finishing; (3) spinning, weaving, and finishing; (4) finishing and fabricating products; (5) fabricating and wholesaling; or (6) fabricating, wholesaling, and retailing. Most of the largest companies in the textile industry fall into the group combining spinning, weaving, and finishing. Some of these large integrated companies also produce some finished consumer items. A few companies combine all stages from spinning through retailing.

Companies may have different mills for different functions or they may combine two or more functions in one mill. In 1982, more than 65 percent of the total

Table 42--Textile mill products industry consumption of raw cotton

Industry 1/	Cotton consumed		Proportion of total	
	1977	1982	1977	1982
	- - -1,000 bales - -		- - - - -Percent - - - -	
Yarn and thread mills	1,723.9	1,624.9	27.0	32.6
Cotton-weaving mills	3,325.0	2,213.4	52.0	44.6
Manmade fiber-weaving mills	1,202.4	1,056.6	18.8	21.3
Wool-weaving mills	0	0	0	0
Narrow-fabric mills	17.0	15.0	.3	.3
Knitting mills	70.3	47.3	1.1	1.0
Dyeing and finishing plants	0	0	0	0
Floor-covering mills	0	0	0	0
Miscellaneous textile mills	53.0	8.6	.8	.2
Total	6,391.6	4,966.8	100.0	100.0

1/ Three-digit SIC industry groups as defined by the Standard Industrial Classification Manual, 1972 (37).

Source: (32).

production of spun cotton yarn was consumed in the same establishment in which it was produced. The remainder was sold mainly to small weaving mills without spinning equipment, to knitting mills, narrow fabric mills, thread mills, and other users.

Broadwoven fabric mills bought 66 percent of the raw cotton purchased by all manufacturing industries in 1982, and produced yarn as well as broadwoven fabric (table 42). Gray goods made up the major part of production in those mills, but they also accounted for a large part of the finished fabric. They sold finished fabric to apparel and other manufacturers or used it in fabricating sheets, pillowcases, towels, and similar consumer items. In 1982, almost 51 percent of the total production of finished cotton broadwoven goods were produced in weaving mills, and about 48 percent of this was consumed in the same establishment.

Some knitting mills manufacture the yarns they use in knitting. Some mills knit, dye, and finish fabrics, and some manufacture outerwear, underwear, and nightwear from fabric they have knitted in the same establishments.

Companies have integrated production to ensure an uninterrupted supply of suitable raw materials and to come in closer contact with buyers further along in the marketing channel. Thus, some companies are able to develop and promote branded products. Furthermore, integration usually means spreading some overhead costs over more units of production.

Apparel Industries

Firms in the apparel industry are frequently called cutters.2/ These firms buy finished fabrics from converters, finishers, or textile mills. They manufacture apparel items such as coats, trousers, dresses, shirts, and hats, and sell the finished products. Firms that buy fabrics and manufacture apparel are known as "manufacturers." Firms known as "jobbers" mainly buy raw materials, arrange for their manufacture in plants operated by contractors, and sell the finished products. Some jobbers do the cutting of the materials in their own establishments. "Contractor" firms process materials owned by others.

The apparel industry is made up of many relatively small firms, with modest capital, producing numerous styles, sizes, and types of clothing, usually in small lots.

In recent years, a significant volume of yarn, fabric, and semimanufactured products has been imported by the apparel industry, bypassing traditional domestic supplies. For example, during 1984, imports of these products accounted for about 13 percent of the total U.S. consumption of yarn and

---

2/ This section primarily discusses establishments in the following Standard Industrial Classifications: Men's and Boys' Suits and Coats (SIC-2311); Men's and Boys' Furnishings (SIC-232); Women's and Misses' Outerwear (SIC-233); Women's Undergarments (SIC-234); Headwear (SIC-235); and Children's Outerwear (SIC-236). Data for these have been combined to form two larger groups: Men's and Boys' Apparel and Women's and Children's Apparel. The Apparel and Related Products Group for which data are reported in the Census of Manufactures includes three other Standard Industrial Classifications: Fur Goods (SIC-2371), Miscellaneous Apparel (SIC-238), and Fabricated Textiles, not elsewhere classified (SIC-239).

fabric. Foreign textile producers supplied the U.S. apparel industry with production inputs at competitive prices and qualities. Apparel imports, however, have risen at an annual average rate of 6.3 percent during 1960-84, reaching approximately 37 percent of total U.S. domestic consumption in 1984.

Number, Location, and Employment

In 1982, 14,534 companies produced apparel and related products in 16,055 manufacturing establishments (table 43). Both the number of companies and operating establishments have declined by about 5 percent since 1977 in response to interrelated factors such as increased manufacturing costs, technological advances in production, and the increasing share of the U.S. apparel market supplied by imported textiles.

Table 43--Manufacturers of apparel: Number of companies and establishments, and selected employment and payroll data

Item	Men's and boys' apparel 1/		Women's and children's apparel 2/		Total	
	1977	1982	1977	1982	1977	1982
	Number					
Companies	2,846	2,353	12,367	12,181	15,213	14,534
Establishments:						
Total	3,750	3,072	13,302	12,983	17,052	16,055
With over 20 employees	2,596	2,160	7,000	6,454	9,596	8,614
	Thousands					
Total employment	463	374	620	588	1,083	962
	Number					
Employees per establishment	124	122	47	45	64	60
	Million dollars					
Total payroll	3,162	3,714	4,294	5,727	7,456	9,441

1/ Includes manufacturers of men's and boys' suits, coats, dress shirts, nightwear, underwear, neckwear, trousers, work clothing, and clothing not elsewhere classified.

2/ Includes manufacturers of women's, misses', and children's outerwear, underwear, dresses, blouses, coats and suits, headwear, corsets, and allied garments, and outerwear not elsewhere classified.

Source: (32).

Manufacturers of men's and boys' apparel declined about 17 percent during 1977-82, compared with only about a 2-percent drop in producers of women's and children's apparel. Establishments producing men's and boys' apparel are relatively large operations generally requiring more labor and manufacturing equipment than most other types of apparel producers. In 1982, approximately 70 percent of all establishments producing men's and boys' apparel employed more than 20 persons, while about one-half of the manufacturers of women's and children's apparel employed more than 20 persons. For all apparel producers combined, however, employment totaled 962,000 in 1982, or the equivalent of 60 employees per establishment. With a total payroll of over $9.4 billion in 1982, the industry ranks as a major employer in many areas.

The production of apparel is concentrated primarily in the New England and Middle Atlantic States, but is also widely dispersed geographically among most other States. In 1982, approximately 55 percent of the establishments manufacturing men's and boys' apparel were located in New England and the Middle Atlantic States, especially in New York, New Jersey, and Pennsylvania. A significant number of plants are also located in the South Atlantic region. The proportion has been increasing, as many firms find advantages in being closer to the source of raw materials and semiprocessed inputs. On the west coast, the production of men's and boys' apparel is also growing, especially in California, where about 7 percent of all such apparel is now produced.

Although production of women's and children's apparel remains highly concentrated in New England and the Middle Atlantic States, the proportion of total establishments has dropped from about 72 percent in 1977 to 65 percent in 1982. An increasing share of women's and children's apparel is now manufactured in California, where the State's growing apparel industry contained nearly 24 percent of all producers of women's and children's apparel, including over one-third of all women's and girls' dresses.

WORLD PRODUCTION, CONSUMPTION, AND TRADE

Cotton is grown in about 75 countries. But in 1985, the United States, China, and Soviet Union accounted for nearly 60 percent of world production. Although world consumption of cotton has increased greatly since 1960, per capita cotton consumption has remained about the same. Cotton is an important source of foreign exchange for the United States, the Soviet Union, China, Egypt, Sudan, Pakistan, Turkey, Mexico, Colombia, and Paraguay.

Raw Cotton Production and Consumption

World cotton production increased about 2.5 percent annually during 1960-84, rising from 46 million bales in 1960 to 88 million bales in 1984, then dropped to 79 million bales in 1985 (table 44). Most of this increase since 1960 has resulted from higher yields per acre; the harvested area has remained fairly stable at about 32-34 million hectares. World yields averaged about 314 kilograms per hectare during 1960-62, compared with 505 kilograms per hectare during 1982-85. Average yield reached a record high 556 kilograms per hectare in 1984, up 86 percent since 1960. Producers worldwide have increased efficiency by adopting improved varieties, using more fertilizer, irrigating more acreage, improving management of crop pests, and adopting other yield-increasing techniques. However, neither hybrid cotton nor genetic engineering developments should dramatically affect yields over the next 10-15 years.

The United States accounted for about 17 percent of world production in 1985, compared with about 31 percent in 1960. The Soviet Union and China have greatly increased their cotton production since 1960, in response to a policy of self-sufficiency and production incentives. The Soviet Union accounted for about 15 percent of global production in 1985, while China's cotton production increased dramatically since 1981 in response to a rise in area harvested and record high yields. Foreign cotton production has expanded for several reasons: (1) world consumption is increasing, (2) foreign governments like to encourage their local textile industries, (3) cotton is a high-value cash crop suitable for export, (4) the strong dollar opens up new markets to foreign producers of cotton textiles, and (5) relatively high U.S. loan rates kept U.S. prices artificially high compared with those of some foreign competitors.

Total cotton consumption increased by about 29 million bales (480-pound net weight bales) over the last 25 years, from 45 million bales in 1960 to 75 million bales in 1985 (table 45). The greatest expansion of mill use since the early 1960's has been in the developing countries of Asia and Africa, with China the quantity leader. Total mill consumption in the United States and the European Community (EC), on the other hand, has declined since 1960. The growing dominance of cotton consumption in Asia is indicated by its share in world consumption, about 67 percent in 1984. The growth in Soviet cotton consumption, steadily rising in past years, has recently slowed, due in part to a sharp increase in manmade fiber production.

Global per capita cotton consumption has remained about the same during 1960-85, in contrast to a rising per capita consumption of total apparel-type fibers. Cotton's share of the world textile fiber market declined from about 70 percent in 1960 to about 50 percent in 1985. All natural fibers have lost markets to manmade fibers, especially during the past 20 years. The development of polyester in the 1950's brought intense competition with cotton, rayon, and acetate and contributed to cotton's loss of market share.

World carryover stocks were held at manageable levels in most years during 1960-83, ranging from about 20 million bales in the early 1960's to about 25 million bales following the 1981-83 crops. Following the record-high production of 1984, however, world stocks rose to nearly 42 million bales, up 68 percent from a year earlier. About 46 percent of these stocks were held by China. Prior to the 1983 crop, the United States was the dominant holder of stocks, but China's stocks have greatly exceeded those of any other nation since 1983. World production exceeded consumption by about 17 million bales in 1984. Production declined in China, Brazil, Mexico, and Turkey in 1985, but world stocks continued to increase to 48 million bales.

Raw Cotton Trade

The forces affecting world cotton trade are complex. Cotton is an input into the production of clothing, so it can be traded as raw cotton, yarn, fabric, or finished apparel. The United States is usually a competitive exporter of raw cotton. But, other countries, many of them also cotton producers, are more competitive as exporters of finished products. The demand for U.S. cotton exports depends heavily on (1) foreign cotton production, (2) U.S. cotton price in relation to the cotton prices of

Table 44--Cotton area harvested, yield and production, selected countries and world

Year 1/	Brazil	China	India	Pakistan	United States	Soviet Union	World
				1,000 hectares			
Area:							
1960	2,023	5,301	7,677	1,312	6,195	2,191	32,269
1965	2,226	4,775	7,932	1,568	5,510	2,428	33,067
1970	2,469	4,997	7,689	1,748	4,514	2,752	31,885
1975	1,815	4,955	7,446	1,851	3,560	2,922	29,992
1976	1,990	4,929	6,900	1,865	4,417	2,950	30,595
1977	2,015	4,845	7,450	1,843	5,372	2,992	33,163
1978	1,965	4,867	8,119	1,902	5,018	3,038	32,957
1979	1,975	4,512	8,078	2,023	5,193	3,090	32,313
1980	2,015	4,920	7,823	2,108	5,348	3,147	32,230
1981	2,070	5,185	7,987	2,215	5,601	3,168	33,152
1982	2,113	5,828	7,871	2,263	3,939	3,188	31,691
1983	1,975	6,077	7,765	2,221	2,973	3,192	31,001
1984	2,420	6,923	7,437	2,236	4,200	3,347	33,894
1985	2,175	5,140	7,900	2,366	4,140	3,305	31,952
				Kilograms per hectare			
Yield:							
1960	210	172	131	232	500	676	299
1965	244	347	126	266	590	790	362
1970	199	458	125	311	492	852	376
1975	218	479	155	267	508	865	380
1976	276	420	156	224	522	886	403
1977	237	422	165	300	583	907	425
1978	295	445	167	244	471	853	395
1979	293	487	162	368	613	904	440
1980	309	549	169	341	453	934	438
1981	312	571	174	343	608	912	464
1982	308	616	175	364	661	815	463
1983	282	763	171	214	569	823	470
1984	398	903	232	451	673	700	556
1985	377	805	231	525	706	795	547
				1,000 bales 2/			
Production:							
1960	1,950	4,200	4,630	1,398	14,237	6,800	46,174
1965	2,499	7,600	4,600	1,915	14,938	8,810	54,435
1970	2,251	10,500	4,400	2,500	8,204	10,770	55,035
1975	1,815	10,900	5,300	2,269	8,302	11,610	54,061
1976	2,526	9,500	4,950	1,921	10,581	12,010	56,740
1977	2,196	9,400	5,655	2,539	14,389	12,470	63,915
1978	2,664	9,950	6,213	2,132	10,856	11,907	59,639
1979	2,659	10,100	6,011	3,417	14,629	12,833	65,194
1980	2,857	12,400	9,090	3,300	11,122	13,498	64,815
1981	2,962	13,600	6,400	3,494	15,646	13,277	70,773
1982	2,985	16,500	6,324	3,781	11,963	11,932	67,456
1983	2,554	21,300	6,086	2,188	7,771	12,058	67,648
1984	4,423	28,700	7,925	4,628	12,982	11,876	88,113
1985	3,766	19,000	8,400	5,700	13,432	12,095	78,918

1/ Beginning August 1.
2/ 480-pound net-weight bales.

Source: (28).

competing exporters, (3) the price of cotton in relation to other fibers, and (4) the economic growth rate in importing nations. For example, a 1-percent increase in real income of foreign importing countries is associated with about a 120,000-bale increase in U.S. cotton exports. If our major competitors increase their production by 1 million bales, U.S. exports might drop by about 600,000 bales in the short run.

World cotton production has increased from an average of 48.3 million bales in 1960-64 to about 72.9 million bales in 1980-85, a 50-percent increase. Cotton trade, however, increased only 19 percent in the same period, from an average of 16.7 million bales to 19.8 million bales. Hence, a larger share of world cotton production is now milled within producing countries. These and other market developments mean that world producers in search of export growth will compete for a larger share of a slowly expanding market.

Imports

The world cotton trade grew about 1 percent annually during the period 1960-72, but little or not at all since 1972. Most of the growth in imports originated in developing Asian nations where cotton textile manufacturing expanded to meet growth in domestic demand and in cotton textile exports. Cotton manufacturing capacity continues to shift from developed to developing nations. Eight countries account for 50-60 percent of world cotton imports. Japan is the most important cotton importer with a 15-percent share of world imports in 1982-85 (table 46).

Table 45--Cotton consumption in specified countries and world

Year 1/	China	India	Japan	Republic of Korea	United States	Soviet Union	World
				1,000 bales 2/			
1960	5,200	4,605	3,428	270	8,353	6,200	45,359
1965	7,900	5,000	3,200	340	9,596	6,950	52,121
1970	10,500	5,250	3,508	550	8,204	8,170	57,300
1975	11,500	6,150	3,166	913	7,250	8,900	61,705
1976	11,600	5,700	3,110	951	6,674	8,950	60,431
1977	12,200	5,185	3,063	1,156	6,509	8,950	59,655
1978	13,100	5,576	3,288	1,270	6,352	9,075	63,286
1979	14,100	6,009	3,355	1,550	6,506	9,100	66,155
1980	15,100	6,306	3,295	1,447	5,891	9,150	65,969
1981	16,200	6,000	3,426	1,550	5,264	9,150	66,114
1982	16,400	6,230	3,290	1,565	5,513	9,200	68,215
1983	16,000	6,500	3,300	1,615	5,928	9,400	68,935
1984	15,500	7,117	3,187	1,637	5,540	9,500	69,106
1985	17,500	7,191	3,146	1,700	6,399	9,700	74,648

1/ Beginning August 1.
2/ 480-pound net-weight bales.

Source: (28).

The Japanese share fell 2-3 percent during the 1970's as other East Asian textile producers--Taiwan, Hong Kong, and the Republic of Korea--expanded mill capacity and increased cotton imports. In 1982-85, the Republic of Korea purchased 8 percent of world cotton imports while Taiwan and Hong Kong had import market shares of 6 percent and 5 percent, respectively. The share of trade held by China increased from an average of less than 3 percent in 1960-64 to more than 17 percent in 1979 and 1980. China's imports have tapered off sharply since 1980, however, as Chinese cotton production has expanded. In 1985, Chinese cotton imports were less than 1 percent of world imports. China will probably not become a large importer again because of impressive gains in cotton production technology and area planted. As a result, China has become a net exporter of raw cotton.

Major European cotton importers--France, Italy, and Germany--have declined in importance since the early 1960's as these countries have moved heavily into the use of manmade fibers. Each of these countries purchases 4-5 percent of world cotton imports.

The United States limits annual imports of raw cotton to 14.5 million pounds (about 30,240 bales) of short-staple cotton having a length of less than 1-1/8 inches, and 45.7 million pounds (about 95,118 bales) of long-staple cotton having a length of 1-1/8 inches or more. Raw cotton imports have not approached these quota limits in recent years, having averaged about 22,000 bales in 1982-85.

Exports

Cotton has been an important export crop for nearly 200 years. In 1850, nearly 90 percent of U.S. lint production was exported, with the earnings offsetting the costs of about two-thirds of all goods imported into the United States. In 1984, about 6.2 million bales, or nearly 50 percent of the U.S. crop, was exported.

The United States and the Soviet Union are the world's largest cotton exporters, with 1982-84 shares of 31 percent and 16 percent. The U.S. share has varied substantially since 1960, ranging from 10-40 percent of world exports (table 46). The U.S. share dropped to 10 percent in the 1985/86 marketing season. Much of the variation in market share is explained by relative prices for U.S. cotton and cotton from competing exporting countries. Abundant harvests in competing exporting countries also reduce U.S. exports.

The United States provides for a high proportion of total imports of raw cotton by several countries, including Japan, Korea, Taiwan, Indonesia, Thailand, and Canada (table 47). Japan was the largest single export market for the United States during 1982-85, followed closely by Korea. The United States holds the largest market shares of imports by Canada and Korea.

During the 1950's and early 1960's, when U.S. price support rates were high in relation to the world prices, a payment-in-kind program was used to promote exports. That program was discontinued in 1967. Such a program provides an indirect advantage to foreign textile manufacturers which compete with U.S. mills. During fiscal years 1981-84, from 500,000 to 900,000 bales a year were exported under a credit guarantee program (GSM-102) administered by the Commodity Credit Corporation (CCC), but no appropriated funds were used. Although exports under Public Law 480 (P.L. 480) were important in some

Table 46--Cotton trade, selected countries and world

Year 1/	Egypt	Pakistan	Sudan	Turkey	United States	Soviet Union	World
	Exports						
	1,000 bales 2/						
1960	1,582	244	437	286	6,857	1,750	17,123
1965	1,575	492	570	959	3,035	2,240	16,930
1970	1,397	473	1,049	1,124	3,897	2,450	17,748
1975	775	418	1,097	2,163	3,311	3,890	19,073
1976	606	65	607	580	4,784	4,300	17,574
1977	686	471	689	1,218	5,484	4,160	19,140
1978	690	246	814	962	6,180	3,756	19,790
1979	876	1,177	805	617	9,229	3,770	23,244
1980	749	1,490	415	1,028	5,926	4,070	19,711
1981	898	1,097	475	956	6,567	4,295	20,228
1982	920	1,273	640	654	5,207	3,890	19,441
1983	780	377	1,004	499	6,786	3,202	19,227
1984	657	1,171	650	666	6,215	3,200	20,285
1985	675	3,148	725	322	1,960	3,000	20,458
	Imports						
	China	Italy	Japan	Republic of Korea	Taiwan	Federal Republic of Germany	World
	1,000 bales 2/						
1960	300	995	3,535	216	200	1,426	17,313
1965	500	1,013	3,078	327	305	1,250	17,132
1970	500	816	3,669	557	735	1,084	18,872
1975	900	886	3,220	1,013	1,024	1,040	19,530
1976	650	875	3,037	909	801	887	17,911
1977	1,600	860	3,150	1,312	1,052	967	19,977
1978	2,125	1,020	3,382	1,363	855	815	19,845
1979	4,100	1,118	3,336	1,627	1,248	888	23,149
1980	3,550	870	3,207	1,527	981	724	20,707
1981	2,100	1,001	3,504	1,496	1,192	894	19,972
1982	1,100	1,078	3,137	1,562	1,044	1,039	19,702
1983	250	1,150	3,338	1,602	1,171	988	20,426
1984	100	1,162	3,127	1,601	1,295	1,070	20,030
1985	1	1,195	3,054	1,681	1,534	928	19,888

1/ Beginning August 1.
2/ 480-pound net-weight bales.

Source: (28).

earlier years, fewer than 37,000 bales each year were exported through P.L. 480 during 1981-84. In fiscal year 1985, more than 1 million bales were exported under the credit guarantee program, and about 65,000 bales were exported through P.L. 480.

U.S. exports began to drop significantly during the last 5 months of the 1984/85 marketing season as increasing quantities of the 1984 foreign crop became available and as the strong dollar and the U.S. farm program made it increasingly difficult for U.S. cotton to be price competitive. For example, the April 12, 1985, Outlook Index "A" price level was reported at 65.95 cents per pound, c.i.f. Northern Europe, while the comparable U.S. Memphis Territory price exceeded the index price by nearly 11 cents per pound. That relationship widened to nearly 30 cents through May 1986, as the "A" Index continued to drop to 44.20 cents on May 30. U.S. exports during 1985/86 totaled about 2 million bales, down from 6.2 million bales the previous year.

The United States will probably continue as a leading exporter of raw cotton. However, its share of world exports will depend on the level of economic growth abroad, the value of the dollar, and U.S. versus world cotton prices. The Food Security Act of 1985 includes provisions designed to enable U.S. cotton and other commodities to compete at world price levels. U.S. cotton exports should rebound under the marketing provisions of this legislation, which became effective August 1, 1986.

Although the Soviet share of world trade almost doubled during 1961-81, Soviet production peaked in 1980 and exports from that country leveled off at about 3 million bales annually during 1983-85. The U.S. lead in exports could diminish if China pursues a strong policy of cotton export expansion. China became a net exporter in 1983/84 with exports totaling 800,000 bales, followed by 1.2 million bales in 1984/85 and an estimated 2.4 million in 1985/86. China has the potential to export much more, but quality, marketing, packaging, and transportation problems are limiting factors.

Other cotton exporters with a significant 1982-84 share of the world market include Egypt (4 percent), Pakistan (4.8 percent), Turkey (3 percent), Sudan (4 percent), Mexico (2.4 percent), Australia (2.6 percent), and Guatemala (1.1 percent). Much of the cotton acreage in these countries requires irrigation, so increases in area planted will require large capital investments. In Turkey, Pakistan, and Egypt, growing domestic demand for the production of textiles for domestic and foreign markets will slow the growth in raw cotton available for export. Sudan has the capability to expand cotton production, but the domestic infrastructure and marketing system will probably limit the growth of its exports.

U.S. Trade in Cotton Textiles

The increasing strength of the U.S. dollar in relation to other currencies in the early- to mid-1980's and the decline in economic conditions in foreign importing nations limited the expansion of U.S. textile exports during this period. Cotton textile exports dropped from 765,000 equivalent bales in 1981 to 429,000 bales in 1984 (table 48). In the meantime, U.S. imports of foreign textile products increased by record amounts. In 1984, cotton textile imports accounted for over 37 percent of total U.S. domestic cotton consumption, or the equivalent of about 3.1 million bales (table 49). Only 2 years earlier, imports represented 29 percent of domestic cotton use, about 1.9 million equivalent bales of domestically produced cotton. Since 1984, however, a

Table 47--U.S. raw cotton exports to selected countries, August-July years

Destination	1981/82		1982/83		1983/84		1984/85		1985/86	
	Exports	Market share	Exports	Market share	Exports	Market share	Exports	Market share	Exports	Market share
	1,000 bales 1/	Percent 2/	1,000 bales 1/	Percent 2/	1,000 bales 1/	Percent 2/	1,000 bales 1/	Percent 2/	1,000 bales 1/	Percent 2/
Japan	1,576	45	1,286	41	1,709	51	1,464	48	520	17
Korea, Republic of	1,397	93	1,322	85	1,269	79	1,257	77	513	31
Taiwan	736	62	378	36	495	42	513	45	46	3
Hong Kong	235	34	158	20	283	28	125	13	1	4/
Italy	37	13	105	10	252	22	301	26	91	8
France	69	8	45	5	154	20	132	17	8	1
Germany, Federal Republic of	89	10	163	16	195	20	195	19	85	9
Portugal	60	11	40	7	69	10	80	12	7	1
Indonesia	286	58	268	54	320	63	258	43	105	15
Thailand	192	75	197	50	244	44	139	25	17	3
Canada	167	92	238	6	227	93	195	87	98	34
China	848	40	20	2	12	5	6	6	0	0
Other	875		987		1,556		1,550		469	
World	6,567	3/ 32	5,207	3/ 27	6,786	3/ 35	6,215	3/ 31	1,960	10

1/ 480-pound bales.
2/ U.S. percentage share of total cotton imports of country of destination.
3/ U.S. percentage share of world exports.
4/ Less than one-half percent.

Source: U.S. Dept. of Agr., For. Agr. Serv., Foreign Agriculture Circular. Various issues.

weaker U.S. dollar and lower raw cotton prices have been boosting U.S. cotton textile exports, but textile imports continue to grow at a greater rate than exports.

U.S. Textile Imports by Country of Origin

Hong Kong remained the largest U.S. supplier of imported textile products during 1984, accounting for more than 280 million pounds, the equivalent of more than 583,000 bales (table 50). This volume represented nearly 20 percent of the total U.S. import market of 1.5 billion pounds.

China, Korea, and Taiwan exported a combined total of 454 million pounds to the U.S. market, while the remaining countries in Asia and Oceania accounted for the equivalent of 444 million pounds of cotton. During 1984, over 80 percent of all U.S. cotton textile imports originated in Asia and Oceania.

U.S. imports from Western Hemisphere countries totaled 183 million pounds, up nearly 25 percent from 1982. Shipments from Western Europe more than doubled from 26 million pounds to nearly 59 million pounds in 1984.

Most U.S. cotton textile imports originate in countries that purchase little or no U.S. raw cotton. In 1984, an estimated 65 percent of all cotton textile imports were shipped from countries that accounted for only about 10 percent of total U.S. raw cotton exports. More than 35 percent came from countries purchasing no U.S. cotton.

Import Trends by Product Class

U.S. imports of the four major classes of textile products during 1982-84 are summarized in table 50. Data are shown for each of the seven major textile exporting nations. These seven countries accounted for over two-thirds of the U.S. import total in 1984.

Imports of cotton apparel products totaled 733 million pounds in 1984, or the equivalent of 1.5 million bales of raw cotton, compared with about 488 million pounds in 1982. While apparel imports continue to account for the largest volume, imports of semimanufactured products, such as yarn and woven fabrics, are growing at a faster rate. Since 1982, imports of cotton yarn and fabric have increased by 94 percent and 73 percent. Most cotton fabric is imported from Hong Kong (68.4 million pounds, raw fiber equivalent, in 1984), but with tighter import quotas and increasing manufacturing costs in Hong Kong and some other major exporting nations, both fabric and apparel imports from other countries have grown rapidly. For example, imports from India, Pakistan, Korea, and Japan about doubled between 1982 and 1984. Cotton apparel imports from other countries accounted for 28 percent of all apparel imports in 1982 and rose to 35 percent by the end of 1984.

Government Programs Affecting World Trade

International trade in raw cotton and cotton textiles is affected by many government actions designed to stimulate exports, stabilize prices, and protect domestic textile and apparel industries (8, 16, 19, 36). U.S. cotton export subsidies have served foreign policy as well as agricultural program goals since 1931 when a Grain Stabilization Corporation loan for the purchase of cotton and wheat was first made to the Chinese Government. Quotas covering imports of raw cotton into the United States were first established in the

Table 48--Raw cotton equivalent of U.S. textile exports

Year/ month	Yarn 1/	Fabric 2/	Household furnishings 3/	Wearing apparel 4/	Industrial products 5/	Total weight	Bales 6/
	1,000 pounds						Thousands
1981	38,072	134,379	54,507	122,936	17,505	367,299	765.2
1982	30,080	89,476	39,473	80,034	14,277	253,340	527.8
1983	31,224	61,848	42,867	72,070	11,601	219,610	457.5
1984	20,202	64,762	37,840	68,264	15,014	206,082	429.3
January	1,781	5,241	2,995	5,772	1,000	16,789	35.0
February	1,524	4,656	3,091	5,960	695	15,921	33.2
March	1,423	5,377	3,186	7,365	1,093	18,444	38.4
April	1,894	4,851	3,665	5,388	1,073	16,871	35.1
May	1,315	5,790	3,794	6,173	1,620	18,692	38.9
June	1,745	6,542	3,516	6,518	1,708	20,029	41.7
July	1,258	5,480	3,019	5,560	1,253	16,570	34.5
August	1,452	4,961	2,895	5,047	1,339	15,694	32.7
September	2,301	5,447	2,816	5,000	1,115	16,679	34.7
October	2,044	6,305	3,222	5,588	1,615	18,774	39.1
November	2,312	4,639	2,806	5,174	1,308	16,239	33.8
December	1,153	5,473	2,835	4,719	1,195	15,375	32.0

1/ Includes yarn, sewing thread, crochet, darning and embroidery cotton, twine, and cordage.
2/ Includes standard constructions and tire cord (fabrics and tire cloth for export to the Philippines to embroider and otherwise manufacture and return to the United States), other tapestry and upholstery fabrics, table damask, pile fabrics and remnants, and knit fabrics.
3/ Includes blankets, spreads, pillowcases, sheets, towels, and other curtains and draperies and household furnishings not elsewhere specified; floor covering; and other household and clothing articles (canvas articles and manufactures, braids, narrow fabrics, elastic webbing, waterproof garments, and lace articles).
4/ Includes knits, gloves, and mitts of woven fabric, underwear and outerwear and woven fabric, handkerchiefs, and wearing apparel containing mixed fibers, corsets, brassieres, girdles, garters, armbands, suspenders, neckties, and cravats.
5/ Includes rubberized fabrics, bags, and industrial belting.
6/ 480-pound net weight bales.

Source: (24).

Table 49--Raw cotton equivalent of U.S. textile imports

Year/month	Yarn 1/	Fabric 2/	Household articles 3/	Wearing apparel 4/	Floor covering	Total weight	Bales 5/
	1,000 pounds						Thousands
1981	24,083	355,000	76,279	503,977	2,561	961,900	2,004.0
1982	28,508	270,525	91,831	510,519	2,408	903,791	1,882.9
1983	42,131	352,253	110,786	622,806	7,526	1,135,502	2,365.6
1984	54,706	473,050	163,349	759,721	14,649	1,465,475	3,053.1
January	6,515	42,741	13,881	59,643	1,137	123,917	258.2
February	6,623	41,237	15,147	67,937	1,125	132,069	275.1
March	5,940	44,636	13,840	69,225	1,564	135,205	281.7
April	6,380	42,438	15,051	57,032	1,264	122,165	254.5
May	5,482	34,251	12,057	55,738	907	108,435	225.9
June	4,124	45,208	11,358	62,371	749	123,810	257.9
July	5,691	46,268	16,528	91,099	1,572	161,158	335.7
August	3,722	42,180	13,653	69,069	1,622	130,246	271.3
September	2,931	37,341	12,868	74,390	1,068	128,598	267.9
October	2,623	37,747	14,530	56,100	1,226	112,226	233.8
November	2,071	31,664	11,556	53,724	1,336	100,351	209.1
December	2,604	27,339	12,880	43,393	1,079	87,295	181.9
1985:							
January	2,736	28,948	13,096	64,155	1,298	110,233	229.7
February	3,844	39,276	13,850	77,672	1,424	136,066	283.5
March	3,460	40,797	15,493	78,696	1,985	140,431	292.6
April	4,446	34,343	12,216	59,262	1,600	111,867	233.1
May	4,118	43,299	14,737	73,248	1,908	137,310	286.1
June	4,016	37,387	13,728	75,584	1,244	131,959	274.9
July	5,251	34,981	13,578	87,450	1,294	142,554	297.0
August	3,961	32,106	12,467	72,363	1,539	122,436	255.1

1/ Includes yarn, sewing thread, crochet, and knitting yarn.

2/ Includes blends (tapestry and upholstery fabrics, tire cord fabrics, cloths primarily cotton, but containing other fibers), pile fabrics and manufactures (velvets, velveteens, corduroys, plushes, and chenilles), and lace fabric and articles (such as nets and netting, veils and veilings, edging, embroideries, and lace window curtains).

3/ Includes bed clothes and towels, blankets, quilts, bedspreads, sheets and pillowcases; table damask and manufactures, household and clothing articles (such as braids except hat braids, tubing, labels, lacing, wicking, loom harness, table and bureau covers, polishing and dust cloths, fabric with fast edges, cords, tassles, garters, suspenders and braces, corsets and brassieres); miscellaneous products (belts and belting, fish nets and netting, and coated, filled, or waterproof fabrics). Includes quantities in the Tariff Schedule of the United States of America (TSUSA) 706 luggage categories. The raw fiber equivalent quantity was 14,091,000 pounds from 1983, and 18,749,000 pounds from 1984. For January-August 1985, these quantities were 2,001,000 pounds, 2,096,000 pounds, 2,447,000 pounds, 2,060,000 pounds, 2,225,000 pounds, 1,986,000 pounds, 2,379,000 pounds, and 1,650,000 pounds, respectively.

4/ Includes gloves, hosiery, handkerchiefs, and other wearing apparel (knit and woven underwear and outerwear; collars, cuffs, shirts, coats, vests, robes, pajamas, and ornamented wearing apparel).

5/ 480-pound bales.

Source: (24).

1930's and have not been amended since 1950. Under provisions of the General Agreement on Tariffs and Trade (GATT) and the Multifiber Arrangement (MFA), the U.S. Government has attempted since 1956 to restrict textile and apparel imports.

Cotton Exports

The Export-Import Bank and its predecessor agencies authorized numerous cotton export loans to China and Europe during the 1930's. However, the first instance of a direct subsidy to cotton exports occurred in 1940 when $41 million in P.L. 320, section 32 funds (import tariff revenue) were used to reduce the export prices on 6.3 million bales of cotton. That same year, the United States bartered 600,000 bales of cotton for 85,000 tons of rubber from the United Kingdom. Section 32 funds were used again in 1941, but were not needed during World War II.

Table 50--U.S. cotton textile imports, by country of origin and product class

Product class/year	Country of origin: India	Pakistan	China	Korea	Hong Kong	Taiwan	Japan	Other countries	U.S. total
	Million pounds								
Yarn:									
1982	0	1/	0	0.2	0	1/	0.3	26.8	27.3
1983	0	1/	1/	2.9	1/	1/	1.2	36.8	40.9
1984	1/	0.2	1/	5.9	1/	0.1	1.0	45.7	52.9
Woven fabric:									
1982	8.7	17.9	41.3	15.8	47.5	34.6	10.6	83.7	260.1
1983	7.5	22.2	54.9	32.6	69.3	49.0	14.2	88.9	338.6
1984	20.2	29.4	65.6	37.6	68.4	57.0	20.8	15.8	450.8
Apparel:									
1982	16.3	8.7	58.4	30.1	173.7	47.5	18.2	135.0	487.9
1983	22.3	10.8	78.0	34.6	205.1	56.7	25.1	164.8	597.4
1984	28.3	16.8	82.8	58.6	191.1	66.3	32.9	256.3	733.1
Bedding and towels:									
1982	5.9	19.7	21.4	1/	2.7	4.1	1/	10.3	64.1
1983	4.5	24.3	14.7	1.0	3.2	6.1	1/	16.3	70.1
1984	6.1	28.9	25.7	1.0	4.7	6.8	1.0	32.2	106.4
All other products:									
1982	4.2	4.1	14.1	3.7	11.5	4.8	3.2	12.2	57.8
1983	7.6	5.0	17.9	2.3	11.9	7.9	4.1	17.6	74.3
1984	14.1	6.6	26.1	3.4	16.1	16.7	5.8	33.5	122.3
Total:									
1982	35.1	50.4	135.2	49.8	235.4	91.0	32.3	268.0	897.2
1983	41.9	62.3	165.5	73.4	289.5	119.7	44.6	324.4	1,121.3
1984	68.7	81.9	200.2	106.5	280.3	146.9	61.5	519.5	1,465.5

1/ Less than 0.05 million.

Source: (24).

During 1946-54, the U.S. Government loaned cotton to China, Japan, and European countries to assist them in reestablishing textile industries. The loans, totaling $1.1 billion through 1954, matured in 15-24 months from the date of shipment and were repaid from textile and apparel sales revenue. Export-Import Bank loans and guarantees for cotton shipments have continued into the 1980's.

Cotton exports continued to benefit from section 32 subsidies after World War II until 1970. During much of that period, U.S. domestic prices were maintained above world market prices, and subsidies, sometimes amounting to over $200 million per year, were required to make U.S. cotton competitive. In most years, cotton was second only to wheat in the amount of section 32 export assistance received.

Soft currency sales, long-term dollar credits, and barter were P.L. 480 programs used to assist agricultural exports beginning in 1955. Barter was especially important for cotton, and because domestic prices were maintained above world prices, almost all cotton exports between 1955 and 1973 moved under some form of assistance.

Beginning in 1974, domestic prices were no longer supported above world prices, and the need for export assistance was much reduced. Limited use of P.L. 480 long-term sales have continued, usually affecting less than $20 million in cotton exports each year. Export-Import Bank loans continue to finance some cotton shipments, but CCC credits and credit guarantees have become the primary form of Government assistance to cotton exports. During fiscal years 1982-85, exports of between 500,000 bales and 1.1 million bales were assisted by CCC credits each year. About 400,000 bales were also exported under the Blended Credit Program in fiscal year 1983. And cotton shipments under P.L. 480 total 30,000-70,000 bales each year.

U.S. Cotton Imports

Raw cotton imports were first limited under the authority of section 22 of the Agricultural Adjustment Act of 1933. That law allowed the President to establish tariffs or quotas to prevent imports from rendering price support programs ineffective. Section 22 controls were last revised in 1950, and the representative period on which quotas for U.S. cotton imports from individual countries are based is July 1, 1928, through June 30, 1933. The country import quotas for cotton shorter than 1-1/8 inches total 30,240 bales per year. Mexico has the largest quota, 18,507 bales.

The global quota for cotton 1-1/8 inches or longer is 95,118 bales per year, and about 5.5 million pounds of cotton waste may also be imported. Global quotas are administered on a first come, first served basis.

Successive farm acts have provided for an additional global import quota equal to 21 days of domestic mill use if the monthly average spot market price exceeds the previous 36-month average by 130 percent or more. The quota was last triggered during 1980. Even in that year, fewer than 30,000 bales were imported into the United States.

Textile Trade

The Multifiber Arrangement (MFA) is an agreement between textile importing and exporting nations which delineates acceptable protectionist measures and provides a framework for bilateral negotiations between countries. The United States first tried to control textile imports in the early 1950's when competition from Japan began to affect American producers. Early textile trade negotiations between the United States and Japan were conducted under the auspices of GATT. During the 1960's, the number of countries participating in negotiations increased, and the MFA was negotiated in 1974. Under the MFA, the United States is committed to allowing an expansion of Third World and Japanese trade in textiles, while also reserving the right to control the rate of Third World and Japanese penetration of U.S. markets. By mutual agreement, the United States, Canada, Western Europe, Australia, and New Zealand do not restrict textile trade among themselves.

The MFA requires member countries to notify each other of changes in quantitative import restrictions and to receive approval of those changes from MFA's Textile Surveillance Body. Approval is granted only when the quantitative import restrictions are limited precisely to products from particular countries that are disrupting a domestic market. In cases where potential damage is imminent and serious, an importing country can request immediate bilateral negotiations with the exporting country to establish new restraints. Under this provision, the United States has established quotas on hundreds of textile and apparel categories from over 30 countries. China has not signed the MFA, but the United States negotiates quotas on imports from China as if China were a signatory.

The United States also collects tariffs on the import value of textile products. Tariff revenue in 1984 totaled $3.3 billion. In 1984, the trade-weighted tariff rate for textile fibers and textile products was about 20 percent. However, the average rates for woven fabrics of cotton, wool, and manmade fibers were about 11 percent, 38 percent, and 20 percent. The average tariff on wearing apparel and accessories was 23 percent. While quotas are applied only to exports from Third World countries and Japan, tariffs are collected on imports from all sources.

GOVERNMENT PROGRAMS AFFECTING COTTON

Two separate U.S. Government programs for cotton are in effect, one for Upland cotton and the other for extra long staple (ELS) cotton. The following chronology of farm programs relates chiefly to Upland cotton programs, ending with a brief description of ELS cotton programs.

Cotton and other farm commodities have been subject to wide swings in production, stocks, and prices since the turn of the century. The productive capacity of U.S. agriculture has generally exceeded the effective demand for many products, including cotton. Government cotton programs since the early 1930's have attempted to support prices and adjust acreage and production to market needs. Upland cotton programs during 1933-65 frequently included acreage allotments, marketing quotas, and parity price supports. Upland cotton programs since 1966 have been more market oriented, featuring price supports based on world price levels and direct payments to participating producers. These programs have provided some price and income stability, and have eased the transition of resources out of cotton production. However, they have not solved the underlying problem of chronic overcapacity of production, loss of markets to manmade fibers, and loss of domestic markets to cotton textile imports. Although cotton programs have changed over the years, the goals and many provisions of recent legislation trace back to the Agricultural Adjustment Acts of 1933 and 1938 (25).

Early Farm Programs

The collapse of agricultural prices following World War I, in combination with rigid nonfarm prices, led to public discussion of possible programs to stabilize commodity prices and increased farm incomes (18). Farm leaders advised farmers to control production on a voluntary basis and to join marketing cooperatives. Legislation as early as 1922 (Capper-Volstead Cooperative Marketing Act) encouraged farmers to establish cooperatives to gain control over output and prices.

The failure of those efforts to limit the acreage devoted to surplus crops and mounting pressure for legislation to cope with a depressed farm economy led to the enactment of the Agricultural Marketing Act of 1929. This act created the Federal Farm Board, which made loans to marketing cooperatives for the purchase and storage of surplus commodities, including cotton. This program failed to achieve its objectives of stabilizing prices or increasing farm income. The failure was partly because of the absence of an effective program to control production, but more directly to declining demand for cotton and other farm products during the depression years. This experience led to enactment of the Agricultural Adjustment Act of 1933, a comprehensive program aimed at controlling production and increasing prices of designated "basic" commodities, including cotton. One of the major goals of this act was to restore farm purchasing power of agricultural commodities to the 1910-14 average level. This concept later became known as "parity" which was translated into parity prices for each of the "basic" commodities. This concept was used to establish minimum levels of price support through the mid-1960's for cotton (table 51). Parity prices were based on a rigid historical formula and failed to reflect changing demand and supply conditions.

Production control became a primary objective of the Agricultural Act of 1933 and subsequent legislation. Farmers could take land out of production in return for benefit payments. In response to very low cotton prices received by farmers in 1932 and an abnormally high carryover, a cotton plow-up campaign in 1933 successfully eliminated about 10 million acres, or one-fourth of the growing crop. Growers received cash payments for their participation in the program. However, before the 1933 crop could be harvested, the deteriorating financial condition of cotton farmers led them to demand price supports. In response, a nonrecourse loan of 10 cents per pound was authorized on the 1933 crop. The term "nonrecourse" means that the producer is not obligated to pay back the full dollar amount of the loan, but instead may deliver the stored cotton to the CCC. Such delivery constitutes payment of the price support loan in full, regardless of the current market value of cotton. The nonrecourse loan remains in effect as a vehicle for establishing a price floor.

In 1934, marketing quotas were legislated to prevent nonparticipants in the acreage control program from sharing in its financial benefits. The quotas restricted the quantity of cotton that each producer could sell without paying a penalty tax. Marketing quotas were a longstanding provision of subsequent cotton programs, ending in 1970, after which voluntary programs were in effect.

The production control and financing features of the 1933 Act were declared unconstitutional by the Supreme Court in 1936. This action was followed by enactment of the Soil Conservation and Domestic Allotment Act in 1936, which provided for payments to farmers who agreed to adopt soil-building practices and shift land from "soil-depleting" surplus crops, such as cotton and wheat,

Table 51--Average price support levels and average prices received by farmers for Upland cotton under early agricultural programs

Year	Level of support: Percentage of parity 1/	Level of support: Price support loan 2/	Season-average price received by farmers (gross weight)
	Percent	Cents per pound	Cents per pound
1933	69.0	10.00	10.17
1934	76.0	12.00	12.36
1935	62.0	10.00	11.08
1936	3/	3/	12.34
1937	53.0	9.00	8.40
1938	52.0	8.90	8.58
1939	56.0	8.75	9.06
1940	57.0	9.40	9.83
1941	85.0	14.42	16.95
1942	90.0	17.42	18.90
1943	90.0	19.51	19.76
1944	95.0	21.33	20.72
1945	92.5	21.39	22.51
1946	92.5	24.68	32.63
1947	92.5	28.19	31.92
1948	92.5	31.49	30.38
1949	90.0	30.03	28.57
1950	90.0	30.25	39.90
1951	90.0	32.36	37.69
1952	90.0	32.41	34.17
1953	90.0	33.50	32.10
1954	90.0	34.03	33.52
1955	90.0	34.55	32.27
1956	78.0	32.74	31.63
1957	81.0	32.31	29.46
1958	80.0	35.08	33.09
1959 4/	80.0	34.10	31.56
	65.0	28.40	NA
1960 4/	75.0	32.42	30.08
	60.0	26.63	NA
1961	82.0	33.04	32.80
1962	79.0	32.47	31.74
1963	79.0	32.47	32.02

NA = Not applicable.

1/ Reflects average level. In 1944 and 1945, the CCC purchased cotton at 100 percent of parity.

2/ Prior to 1961, support was based on 7/8-inch Middling cotton, but all support prices have been converted to 1-inch Middling to make them comparable. Reported on gross weight basis.

3/ Price support loans were not available in 1936.

4/ In 1959 and 1960, producers could elect to (a) plant within their regular allotment and receive support at not less than 80 percent of parity for 1959 and 75 percent for 1960, or (b) increase their acreage by as much as 40 percent over their allotment and receive support at a level 15 percent of parity less than that of choice (a).

Source: (30).

to "soil-conserving" crops, such as legumes and grasses. The soil-conserving payments in the 1936 Act failed to bring about the desired cotton crop reduction. Harvested acreage in 1937 climbed to 33.6 million acres, compared with an average of about 28 million acres each year from 1933 through 1936. A record crop of 18.9 million bales was produced, which exceeded disappearance by nearly 8 million bales.

Mounting crop surpluses and declining farm prices led to the Agricultural Adjustment Act of 1938. This act provided for mandatory price support loans and marketing quotas keyed to acreage allotments. The latter provision was intended to keep production in balance with market needs. Acreage allotments and marketing quotas were used for cotton from 1938 to 1942. The acreage planted to cotton declined to less than 25 million acres under this program. There was not a comparable decline in production because of increasing yields. Carryover stocks remained at more than 10 million bales during this period as exports dropped to about 1 million bales annually. Incomes were bolstered by both parity and conservation payments.

Acreage allotments were not in effect during 1943-49 because of the need to expand wartime production. However, cotton price supports ranged up to 95 percent of parity during these years. Cotton acreage declined during the war and then expanded slowly, reaching 28.3 million acres by 1949, which was over 17 percent above the 1938-42 average. The anticipation of a return to acreage allotments in 1950 may have accounted for part of the large acreage in 1949.

The Agricultural Act of 1948 provided for mandatory price support for cotton at 90 percent of parity if producers approved marketing quotas. Subsequent legislation extended this level of support through the 1954 crop. This act also provided a modernized parity formula that maintained the overall 1910-14 balance between prices received and prices paid by farmers but also reflected the current price relationships among commodities in the most recent 10-year period. The Agricultural Act of 1949 contained a flexible price support provision for cotton and other basic commodities that established support prices at levels ranging from 75-90 percent of parity, depending upon the supply. Cotton prices were supported at 90 percent of parity through 1955.

Acreage dropped about 35 percent in 1950 with the return of acreage allotments and marketing quotas. Production restrictions were again removed during 1951-53 because of the Korean war, and both acreage and production increased substantially. Production reached 16.5 million bales in 1953, a level not exceeded since then (fig. 15). A large portion of that crop was taken by the CCC.

During 1948-55, the relatively high support prices and export prices of U.S. cotton stimulated foreign cotton acreage and production. Foreign acreage increased from 38 million acres in 1947 to 62 million in 1951. U.S. exports dropped substantially during 1952-55. In response, the Agricultural Trade Development and Assistance Act (P.L. 480) was passed in 1954 to stimulate exports by allowing sales for foreign currencies (21). Cotton exports under this program during 1954-70 totaled almost 15 million bales and in some years comprised a large portion of total cotton exports. Cotton sold from CCC stocks to foreign mills during 1955-63 averaged 5.75 cents to 8.5 cents per pound below prices paid by domestic mills. The export subsidies during 1955-63 probably increased U.S. exports of raw cotton, but they probably contributed to a competitive advantage of foreign manufacturers and the subsequent movement of manufactured cotton products back into the higher priced domestic market. Higher U.S. prices also encouraged foreign production of cotton and further inroads of cotton substitutes, notably manmade fibers.

Increased production and stocks during 1950-53 prompted the renewal of allotments and marketing quotas under the Agricultural Act of 1954. Cotton was under a marketing quota continuously from 1954 through 1970. Under the 1954 Act and subsequent programs, cotton acreage harvested declined from the 1951-53 average of 25.7 million acres to 18.1 million acres in 1954-55 and 13.7 million acres during the soil bank years in 1956-58. The soil bank was established by the Agricultural Act of 1956 to reduce the amount of land planted to allotment crops (acreage reserve) and to provide for long-term retirement of cropland to conservation uses (conservation reserve).

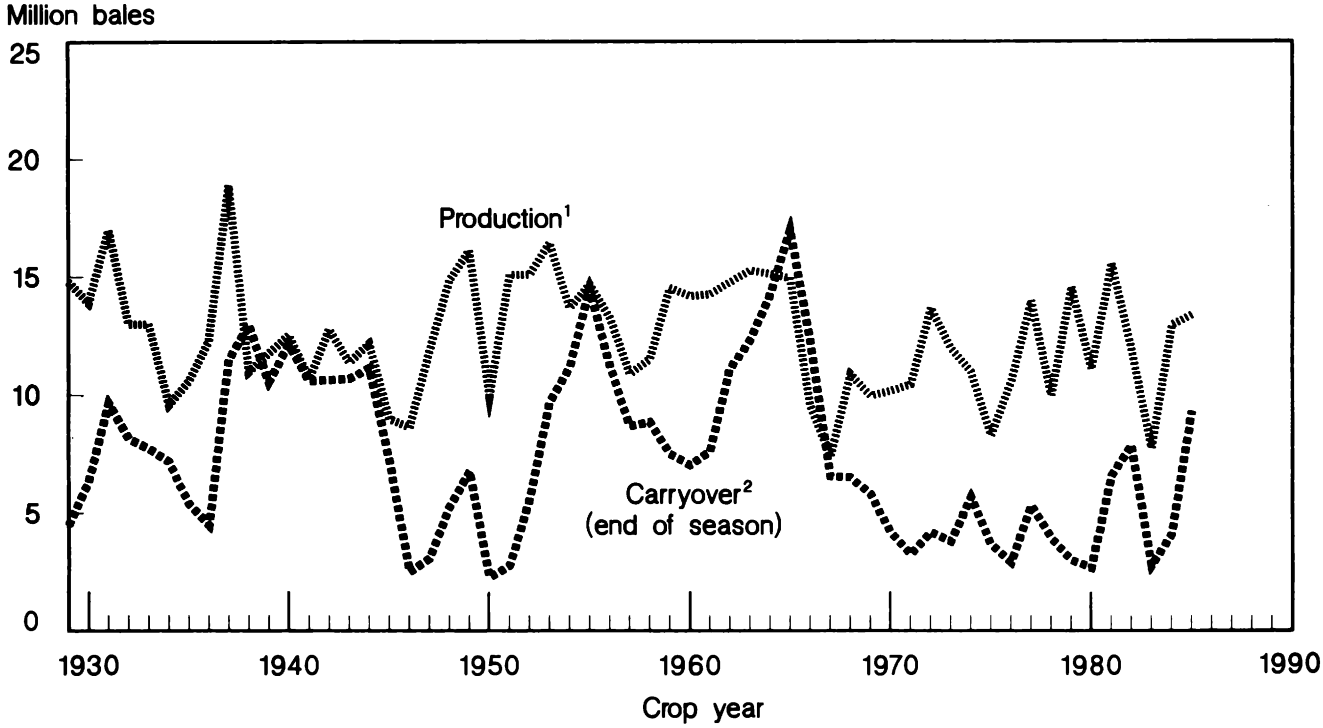
The acreage reserve part of the program was in effect during 1956-58. In 1958, nearly 5 million acres of cotton under allotment were placed in the acreage reserve in response to a payment of 15 cents per pound of lint. The conservation reserve part of the program provided for the removal of cropland from production through contracts for 3-10 years. Acreage diverted from cotton production under the conservation reserve peaked at about 680,000 acres in 1960. Although carryover stocks were reduced substantially from over 14 million bales at the end of the 1955 season to about 7.1 million bales at the end of the 1960 season, the reduction in production capacity was small. The acreage reserve often attracted the less productive land and the conservation reserve was not crop specific. After the acreage reserve program ended in 1958, planted acreage increased in response to high support prices, stocks accumulated, and prices remained near the loan level. A major objection to the program was that communities were disrupted when many farmers placed whole farms in the conservation reserve. Yields continued to increase. Over the next 7 years (1959-65), cotton acreage averaged 14.8 million acres, and the accumulation of cotton stocks was substantial. With the exception of a few years, cotton prices received by farmers remained close to the loan level (table 51). Despite marketing quotas, supplies continued to increase because the allotment level had been reduced to the minimum allowed by legislation, leaving program administrators with no further allotment reduction discretion.

Cotton Programs in the 1960's

In the late 1950's and early 1960's, policymakers had to face the reality that surpluses were mounting and existing legislation provided no effective provision to deal with them. Stocks peaked at nearly 17 million bales at the end of the 1965 crop year, exceeding total use that year by 4.5 million bales. Legislated minimum support prices and allotments, particularly for wheat and cotton, and increasing yields insulated producers from the market. Even so, individual producers were dissatisfied because the allotment rigidities were preventing desired production shifts among crops in which they had a comparative advantage.

The Cotton-Wheat Act of 1964 authorized the Secretary of Agriculture to make subsidy payments to domestic handlers or textile mills, equal to the subsidy paid for export cotton, in order to bring the price of cotton used in the United States down to the export price. This act essentially ended the two-price system that had been in effect since 1956. Also, a domestic cotton allotment, smaller than the regular allotment, was authorized for 1964 and 1965. Producers who planted within the domestic allotment received a higher support. This act had two elements common to attempts to deal with surpluses: demand enhancement and voluntary acreage reduction. The 1964 Act

Figure 15
U.S. cotton production and carryover



1/ 480-pound net-weight bales from 1956 to date; prior to 1956, running bales.
2/ 480-pound net-weight bales from 1953 to date; prior to 1953, 500-pound gross-weight bales.

was the beginning of voluntary programs for reducing cotton production. However, this act only slightly affected production and carryover.

The Food and Agriculture Act of 1965 substantially changed the Upland cotton program. During the first 30 years of farm programs, acreage allotments and marketing quotas, combined with high support prices, were prominent features. During this period, relatively high U.S. price support levels based on parity effectively established both the U.S. farm price and the world market price. Programs provided some price and income stability and also provided an incentive for foreign cotton production and some loss of markets to manmade fibers. Support prices above market-clearing levels encouraged over-production in the United States, and excess stocks led to production controls. The 1965 legislation covered 4 years, 1966-69, and was later extended to 1970. This act was more market-oriented, with price supports for cotton, wheat, and feed grains set below world market prices. The market price of cotton was supported at 90 percent of estimated world price levels.

Incomes of cotton farmers were maintained through payments based on the extent of participation in an acreage reduction program. A minimum acreage reduction of 12.5 percent of the cotton acreage allotment was required of participants. Higher support levels were offered to those producers with small allotments. Similar provisions for small farms were in effect through 1977. For the first time, sale and lease of allotments within a State were permitted. Planted cotton acreage dropped from 14.1 million acres in 1965 to 10.3 million acres in 1966. The price support loan dropped from 29 cents to 21 cents. However, that reduction was offset by a price support payment to producers (table 52). Export subsidies and payments to domestic handlers or mills were discontinued. Starting in 1966, cotton producers joined wheat and feed grain producers in diverting cropland acreage to approved conserving uses. Cotton production dropped substantially during 1966-68 as a result of attractive diversion payments and low yields in 1966 and 1967.

By the end of the 1970 season, the huge CCC inventory of cotton was gone. The voluntary programs to reduce acreage had met the objective of reducing or eliminating surpluses, but they had raised a new issue: the direct U.S. Treasury cost of programs and the amount of payments going to large producers. Government payments to cotton producers averaged $847 million annually during crop years 1966-70, about 40 percent of the total income from cotton.

Cotton Programs in the 1970's

The Agricultural Act of 1970 established a voluntary program for cotton and suspended marketing quotas for 3 years. This suspension continues. The act also provided for a cropland set-aside program in which diversion of cropland to conserving uses could not exceed 28 percent of the farm's base acreage allotment. The set-aside payment to participating farmers was specified as the difference between the higher of 65 percent of parity or 35 cents a pound, and the average market price for the first 5 months of the marketing year. This payment, however, could not be less than 15 cents per pound. The 1970 Act put a separate $55,000 annual limit on Government payments to producers of Upland cotton, wheat, and feed grains. The limit applied to all direct payments but did not include CCC loans or purchases. The loan rate was established at 90 percent of the average world price for the previous 2 years.

The 1970 Act's provisions continued to recognize the importance of the world market price through the way the loan rate was set. The set-aside concept gave producers a wider latitude in crop selection and mix because there was no restriction on the acreage of cotton or other nonquota crop that could be planted after a specific percentage of the farm's base acreage allotment was diverted. However, cotton producers would lose some allotment if less than 90 percent of their farm allotment were planted to cotton.

The issue of large payments was addressed by the $55,000 payment limitation. The limit had little impact on total payments because large producers often divided ownership of their farming operations, which allowed a unit to have multiple recipients.

A set-aside program was in effect in 1971 and 1972. The 2-million-acre set-aside was half of the acreage diverted in 1966-68. Planted acreage reached 14 million acres in 1972 for the first time since 1965. The increase in acreage was a result of higher price expectations at planting time and the elimination of planting restrictions. Unlike previous programs, the farm cotton allotment in 1971-73 did not limit the acreage of cotton that a participant could plant. However, set-aside payments were based on production from acreage planted within the base acreage allotment rather than the total acreage planted.

By 1973, the worldwide demand for American farm products was at a high level because of world crop shortages, devaluation of the dollar, and generally favorable worldwide economic growth. Stocks that had built to surplus levels in the 1950's and 1960's were greatly reduced to about 3.8 million bales, none of which were owned by CCC. The Agriculture and Consumer Protection Act of 1973 was debated and passed in a far different setting than the acts since 1954. Many agricultural interests felt the setting had changed from a situation of chronic surpluses and income problems to a situation where the Government could minimize its role in providing price and income supports for crops.

A major feature of the 1973 Act was the target price concept. Target prices were provided in recognition that agriculture faces weather and market extremes which at times result in low incomes, and that income support should not affect the market price. Deficiency payments would be made only if calendar year average market prices fell below target price levels. Payment rates could not exceed the difference between target prices and price support loans. The loan rate for Upland cotton was established to reflect 90 percent of the average price of American cotton in world markets for the preceding 3-year period. The act specified target price levels for 1974 and 1975 and

Table 52--Average price support levels and average prices received by farmers for Upland cotton

Year	Level of support: Price support loan 1/	Level of support: Price support payment 2/	Level of support: Total support or guarantee 3/	Season-average price received by farmers 4/
	Cents per pound			
1964	30.00	3.50	33.50	29.62
1965	29.00	4.35	33.35	28.03
1966	5/ 21.00	9.42	30.42	20.64
1967	20.25	11.53	31.78	25.39
1968	20.25	12.24	32.49	22.02
1969	20.25	14.73	34.98	20.94
1970	20.25	16.80	37.05	21.86
1971	19.50	15.00	35.00	28.07
1972	19.50	15.00	35.85	27.20
1973	19.50	15.00	41.52	44.40

1/ For Middling 1-inch cotton. Gross weight basis through 1970; net weight thereafter.
2/ Available on domestic allotment for 1964-70 crops; for 1971-73, represents minimum payment rate on full base acreage allotment.
3/ For 1964-70 crops, represents total support on domestic allotment; for 1971-73 crops the final payment, together with the national average market price, had to equal the higher of 35 cents or 65 percent of parity, but not be less than 15 cents per pound.
4/ Price supports and prices received were based on gross weight of cotton and wrapping prior to 1971; all quotations from 1971 to date are net weight.
5/ For 1966 and subsequent years, loan rate set at 90 percent of average price of American cotton in world markets during a specified period.

Source: (30).

provided a specific adjustment formula based on the index of prices paid for farm inputs and changes in productivity as measured by yields for 1976 and 1977. The use of set-aside was authorized but not required during the period covered by the 1973 Act. The payment limit was lowered to $20,000 per person and applied to payments for wheat, feed grains, and cotton combined.

Another new concept introduced in the 1973 Act was disaster payments. Participating producers in the wheat, feed grain, and cotton programs who were prevented from planting any portion of allotments or who suffered low yields because of a natural disaster received a payment based on a percentage of the target level of support. Disaster payments were made for each of the 1974-82 crop years (shown by crop year in table 53 and by fiscal year in app. table 9).

The target price, set-aside, and disaster programs applied to national base acreage allotments that were determined and apportioned by the Secretary of Agriculture. Additional plantings were not eligible for support, but no penalties were imposed.

The increase in 1974 acreage over 1973 resulted largely from attractive prices for cotton (table 54). However, cotton acreage plummeted in 1975, chiefly because of a strong cost-price squeeze and significant shifts from cotton to soybeans in the Delta and the Southeast. Acreage planted averaged 12 million acres during 1974-77, about 1 million acres less than during 1971-73. Ending stocks, however, averaged somewhat higher than those in 1971-73, as domestic mill use continued to trend downward. Stocks were not burdensome, however, as farm prices averaged about 15 cents a pound higher than the loan rate. No deficiency payments were made through 1977, as the average market price received exceeded the target price.

The setting for legislation to extend or replace the 1973 Act was one where the focus was on falling farm income. Stocks were far below those of the early 1960's, but commodity prices had not kept pace with production costs, creating a cost-price squeeze. The farm income issue focused on the price and income support structure. The basic rationale of the 1973 Act had been to protect farm income, yet farm income had fallen in 1976 and 1977 without triggering any large-scale support. No deficiency payments had been paid for cotton through 1977, but there had been some disaster payments. Export markets continued strong, so there was still optimism about demand.

The response as embodied in the Food and Agriculture Act of 1977 was to set target prices on the basis of cost of production. Cost of production was used as a guideline in setting the target price levels specified in the 1977 Act, and a formula using cost estimates was defined for subsequent adjustments. The target price increased sharply from 52 cents a pound in 1978 to 70.87 cents in 1981 (table 54). The limit on deficiency payments was raised to $40,000 per person in 1978, $45,000 per person in 1979, and $50,000 in 1980.

The loan rate continued to be based on a percentage of past market prices. The formula was expanded to use the lower of 85 percent of a preceding 3-year average of prices at domestic locations or 90 percent of the average price of specified classes of cotton in northern Europe during the 15-week period beginning July 1 of the year in which the loan level was announced. A minimum loan rate of 48 cents a pound was specified. Loan rates ranged from 48 cents in 1978 to 52.4 cents in 1981.

Another significant change was to base the target price payment calculation on acreage actually planted rather than on an historical allotment. The payment could be reduced by a national allocation factor if producers in the aggregate exceeded an announced national program acreage.

Overall, the 1977 Act was the second attempt at establishing a price and income safety net for producers that would be effective without impinging on the desired market orientation. Cotton acreage and production increased significantly during 1978-81. The 1978-81 average acreage planted to cotton increased to 14.1 million acres from the 12.1-million-acre average for 1974-77. However, stocks during the period were relatively low until 1981, when high yields and lower mill use resulted in a 6.6-million-bale carryover and a 20-cent drop in season-average farm prices received for lint. Prices received by farmers in calendar year 1981 averaged 63.2 cents per pound, compared with the 1981 crop target price of 70.87 cents; thus, deficiency payments were made for the first time since target prices became effective in 1974. The 1977 Act also continued the authority of the Secretary of Agriculture to proclaim cropland set-aside if USDA forecasts indicated a buildup of excess supply. However, mandatory cropland set-side was not required during 1978-81.

The Food and Agriculture Act of 1977 facilitated a shift of cotton production to the lower cost regions of the West and Southwest because benefits were based on recent plantings rather than on an historically based acreage

Table 53--Direct payments to cotton farmers

Crop Year	Deficiency payments	Diversion payments	Disaster payments	Payment-in-kind entitlements	Total
			Million dollars		
1976	0	0	98	0	98
1977	0	0	69	0	69
1978	0	40	188	0	228
1979	0	0	108	0	108
1980	0	0	302	0	302
1981	469	0	81	0	550
1982	523	0	131	0	654
1983	431	3	0	1/ 1,094	1,528
1984	654	0	0	0	654
1985	860	196	0	0	1,056

1/ 4.3 million bales valued at average loan redemption rate of $0.53 per pound.

Source: ASCS Commodity Fact Sheet: Upland Cotton, Agricultural Stabilization and Conservation Service, USDA, annual issues.

allotment. This change encouraged the movement of acreage to efficient producers and to regions where cotton held a comparative advantage.

Cotton Programs in the Early 1980's

The Agriculture and Food Act of 1981 was also debated and developed under a situation of falling farm income. Net farm income had increased in 1978 and 1979, the first 2 years under the 1977 Act, but then began to decline again. The focus of the 1981 debate was on the price and income supports and the provisions or mechanisms affecting their adjustment. The cost of production adjustment formula for target prices had not worked satisfactorily; it was based on an historical moving average of per acre costs and actual yields in estimating unit costs. The formula was applied during a period of increasing inflation with the result that adjustments lagged behind actual conditions. Production costs reflect changes in production inputs and their prices and do not accurately track changing supply and demand conditions.

There was general optimism during the legislation development period that export demand would remain strong. The 1981 Act specified minimum target prices at successively higher levels for all 4 years of the legislation. The Secretary was given authority to adjust target prices based on a number of factors, including changes in the cost of production. A crop-specific acreage reduction program was established. The payment limit for deficiency and

Table 54--Average price support levels and season-average prices received by farmers for Upland cotton

Year	Loan rate 1/	Target price	Season-average price received by farmers (net-weight basis)
		Cents per pound	
1974	27.06	38.00	42.7
1975	36.12	38.00	51.1
1976	38.92	43.20	63.8
1977	44.63	47.80	52.1
1978	48.00	52.00	58.1
1979	50.23	57.70	62.3
1980	48.00	58.40	74.4
1981	52.46	70.87	54.0
1982	57.08	71.00	59.1
1983	55.00	76.00	66.0
1984	55.00	81.00	57.5
1985	57.30	81.00	54.4
1986	55.00	81.00	2/

1/ Base loan rates for SLM 1-1/16-inch cotton (micronaire 3.5-4.9) at average location, net weight.

2/ USDA is prohibited by law from publishing cotton price forecasts.

Source: (25).

diversion payments remained at $50,000 per person during 1982-85. No limits were applied to loans and purchases.

The 1977 Act had removed the vestiges of the historical allotments and bases that traced back to the 1950's and 1960's. The 1981 Act provided for establishment of a crop acreage upon which acreage reductions were to be based. Acreage reduction programs were in effect during 1982-84. The act specified that acreage taken from production was to be devoted to conserving uses.

The cotton loan rate formula followed the same general specifications as in the 1977 Act, based on either domestic or world prices, whichever was lower. However, the minimum loan was raised from 48 cents a pound to 55 cents a pound.

The 1981 Act allowed the Secretary of Agriculture to make disaster payments to producers only if emergency conditions exist or if Federal crop insurance is not available. Although Federal crop insurance was available in all cotton-producing counties in 1982, disaster payments were authorized in the Texas Plains, where adverse weather caused widespread abandonment of cotton acreage. Disaster payments could not exceed $100,000 per person.

The third attempt to set a price and income safety net in conjunction with a market-oriented program again conflicted with actual emerging conditions. The 1981 Act established the 1982-85 target prices at successively higher levels. A worldwide recession reduced both domestic and export demand, inflation rates declined, and yields hit record levels. Surpluses quickly accumulated, despite acreage reduction programs. Supplies of cotton greatly exceeded use during 1981 and 1982. The 1982 cotton acreage dropped 20 percent from 1981 and production fell almost 25 percent. Widespread compliance with the acreage reduction program under the 1981 Act and low cotton prices explain most of the decline. Even after the substantial drop in production, stocks remained considerably above desired levels. Deficiency payments to cotton producers in 1982 totaled over $520 million.

Increased stocks, depressed commodity prices, and lower farm income led to the implementation of the PIK program for the 1983 crop. PIK was added to the existing acreage reduction and cash-paid land diversion programs in order to idle substantially larger acreage. The 1983 loan rate for program participants was 55 cents per pound and the target price was 76 cents (table 54). Eligibility for program benefits and PIK program participation required growers to participate in the 20-percent acreage reduction program. A producer could idle up to an additional 5 percent of the base acreage in return for a cash diversion payment rate of 25 cents per pound of lint. Farmers participating in the 20-percent acreage reduction program had an option of idling an additional 10-30 percent of their base acreage and receiving a payment-in-kind equal to 80 percent of the farm program yield. They also had the option of submitting sealed bids indicating the percentage of their farm program yield for which an in-kind payment would be accepted for idling their entire base acreage. Under the PIK program, 4.1 million cotton acres were diverted to conserving uses, for which producers received payment in surplus cotton from CCC stocks or from cotton under loan. An additional 2.5 million acres were diverted under the regular acreage reduction program (app. table 6). Acreage planted to Upland cotton dropped to 7.9 million acres in 1983 from 11.3 million acres in 1982. Production dropped by 4.2 million bales due to the PIK program and the drought, and stocks dropped from the 7.8 million bales on hand on August 1, 1983, to 2.7 million bales on August 1,

1984. If there had been no Government acreage control program in 1983, an estimated 13.5 to 14.5 million acres would have been planted and ending stocks might have remained near 8 million bales, with farm prices near the loan level (24). However, even with the PIK program and relatively high exports in 1983/84, farm prices remained below the target price. Thus, deficiency payments totaling $430 million were required by law. The estimated value of PIK entitlements was about $1.1 billion.

An acreage reduction program was in effect for cotton in 1984. In order to be eligible for nonrecourse loans and target price protection, producers had to limit their Upland cotton acreage to no more than 75 percent of their cotton acreage base (average of the 1982 and 1983 planted acreage) and restrict the diverted acreage to approved conserving uses. There was no paid land diversion. The target price was 81 cents per pound as specified by law and the loan rate was at the legislated minimum of 55 cents per pound. About 11 million acres were planted in 1984 and 2.5 million acres were devoted to conserving uses.

The record-high 1984 yield, combined with reduced mill use and lower exports in 1984/85, resulted in ending stocks of about 4.1 million bales, up about 1.3 million bales from a year earlier. Deficiency payments to cotton producers in 1984 totaled about $650 million, based on the difference between the target price of 81 cents per pound and the calendar year average price of 62.4 cents.

The Agricultural Programs Adjustment Act of 1984 froze the 1985 target price at 81 cents per pound rather than the 86-cent level specified by the 1981 Act. The average loan rate, however, rose from 55 cents per pound to 57.3 cents per pound for SLM 1-1/16 inch cotton. To be eligible for target price and loan rate protection, farmers could plant no more than 70 percent of their Upland cotton base acreage and were required to devote the reduced acres to conserving uses. The reduced acreage was comprised of a 20-percent acreage reduction program and a 10-percent paid land diversion program. The land diversion payment was based on 30 cents per pound times the farm yield times 10 percent of the farm's base acreage. No payment was made for the regular 20-percent acreage reduction. Producers who participated in the 1985 Upland cotton acreage reduction program were eligible to receive deficiency payments on the number of pounds equal to their cotton-planted acres times their farm program yields. Advance payments equal to half of the diversion payment and half of the expected 1985 deficiency payment could be requested by producers when they signed up to participate. For advance payment purposes, the USDA announced an estimated deficiency payment in 1985 of 19.8 cents per pound.

About 82 percent of the Upland cotton base of 15.8 million acres was enrolled in the 1985 program. About 10.6 million acres of cotton were planted in 1985, and yields exceeded the record-high level of 1984. Production totaled about 13.3 million bales, based on an average yield of 628 pounds per harvested acre. Production at this level greatly exceeded the estimated 1985/86 disappearance (mill use plus exports) of 8.2 million bales, thus adding about 5 million bales to ending stocks. Deficiency payments totaled about $860 million in addition to diversion payments of about $200 million (table 53). The 1985 deficiency payment rate was 23.7 cents a pound, which is the difference between the 81-cent target price and the national average loan rate of 57.3 cents a pound. The national average price received by farmers for Upland cotton lint in calendar year 1985 was 54.7 cents. Because the average price was lower than the loan rate, the deficiency payments were based on the difference between the target price and the loan rate.

The Food Security Act of 1985

The development of new farm legislation in 1985 took place at a time when the cotton market was characterized by falling mill use, lower export expectations, rising stocks, growing textile imports, and low farm prices. Contributing to the sluggish market for U.S. cotton was the record 1984/85 world crop of nearly 88 million bales that exceeded consumption by about 18 million bales. For the first time since 1974, foreign production in 1984/85 exceeded foreign consumption. World ending stocks in 1984/85 reached a record 42 million bales, resulting in a sharp drop in world market prices. Although world production dropped to about 79 million bales in 1985/86, ending stocks rose to about 48 million bales.

The Food Security Act of 1985 established farm policy for 5 crop years, 1986-90. Some major features of past farm acts were retained, including acreage limitations, nonrecourse loans, and target prices, but the act vested the Secretary of Agriculture with more discretionary authority for administering annual commodity programs. The act provides for greater market orientation and more flexibility to promote market competitiveness. The act also specifies declining target price minimums through 1990. Loan rates are tied to an average of past market prices with provisions for allowing loans to be repaid at levels below the loan rate if market competitiveness might be hampered by the formula-determined rate.

The basic loan rate for Upland cotton in 1986 was set at 55 cents per pound for SLM 1-1/16 inch cotton. In 1987-90, the loan rates will be based on essentially the same formula as that used in the 1981 Act: the smaller of (1) 85 percent of the average spot market price during 3 of the preceding 5 market years, or (2) 90 percent of the average of the 5 lowest priced growths among the 10 growths quoted for Middling 1-3/32 inch cotton, c.i.f. northern Europe, adjusted downward by the average difference between the northern European prices and U.S. spot market prices of SLM 1-1/16 inch cotton.

Notwithstanding the above loan formula, the loan rate for 1987-90 crops may not be reduced by more than 5 percent annually from the rate of the preceding crop, and the minimum loan rate through 1990 is 50 cents per pound. In October 1986, the Secretary announced a loan level of 52.25 cents per pound for the base quality of 1987 Upland cotton, a 5-percent reduction from a year earlier.

A major new provision of the 1985 Act provides a loan repayment plan if the basic loan rate is not competitive on world markets. If the world price of cotton, as determined by the Secretary, is below the loan rate, a loan repayment plan must be implemented. The Secretary would choose one of two alternative "market enhancement" plans for repayment of loans. Under Plan A, the Secretary could lower the producer repayment rate by up to 20 percent, thus allowing farmers to redeem their crops and sell them at a more competitive price. Under Plan A, the repayment level must be announced at the same time the Secretary announces the loan rate (by November 1)and cannot thereafter be changed. Under Plan B, repayment rates would vary periodically during the year to keep pace with world markets. For the 1987-90 crops, if the world price, adjusted to U.S. quality and location (adjusted world price), is below 80 percent of the basic loan rate, a loan repayment level may be set at any level between the adjusted world price and 80 percent of the loan rate. Plan A was chosen for the 1986 crop, with a loan repayment rate equal to 80 percent of the basic loan rate for each quality of cotton. Plan B was subsequently selected for the 1987 crop.

If either Plan A or Plan B fails to make U.S. cotton fully competitive in world markets and the world price is below the loan repayment rate, negotiable marketing certificates must be issued to first handlers of cotton. These certificates are redeemable only for cotton under the 1986 cotton program provisions. The value of these certificates is based on the difference between the loan repayment level and the adjusted world price of cotton.

Target prices for Upland cotton were frozen for the 1986 crop at the 1985 level of 81 cents per pound. Subsequent minimum target price levels per pound are 79.4 cents in 1987, 77 cents in 1988, 74.5 cents in 1989, and 72.9 cents in 1990.

If the Secretary determines that the supply of cotton is excessive, an acreage limitation program or paid diversion program, or both, is authorized. The Act specifies that, to the extent practicable, an acreage limitation program should create a carryover of 4 million bales of Upland cotton.

Deficiency payments are made available to eligible producers in an amount computed by multiplying the payment rate by the individual farm program acreage times the farm program payment yield. The payment rate is equal to the target price minus the higher of the national average market price received by producers during the calendar year that includes the first 5 months (August-December) of the marketing year or the basic loan rate determined for the crop. If an acreage limitation program is in effect, and if producers plant cotton for harvest on at least 50 percent but not more than 92 percent of the permitted acreage (base acreage less required reduction), and if the remaining permitted acreage is placed in conservation uses or nonprogram crops, then deficiency payments will be made on 92 percent of the permitted acreage. This requirement is commonly known as the "50/92" provision. If producers plant less than 50 percent or 92 percent or more of their permitted acreage, then deficiency payments are made on the acreage planted for harvest. If no acreage limitation program is in effect, payments may be subject to an allocation factor.

The act specified that the total combined deficiency and diversion payments that a producer may receive annually during 1986-90 under one or more programs for wheat, feed grains, Upland cotton, ELS cotton, and rice may not exceed $50,000. Disaster payments were limited to $100,000 per person. Exempted from the payment limits were loans or purchases, gains realized from repayment of loans under the marketing loan provisions of the act, loan deficiency payments received by participating producers who forego obtaining loans in return for such payments, and inventory reduction (PIK) payments received by producers who forego loan and deficiency payments and reduce acreage by half the announced acreage reduction.

In October 1986, Congress established a new ceiling of $250,000 on total farm payments, effective with all 1987 commodity programs. The new ceiling will include the $50,000 payment limit for regular deficiency payments and land diversion payments, as well as all other Government payments except crop support loans, grain reserve storage payments, Upland cotton first handler marketing certificate payments, and rice marketing certificate payments.

ELS Cotton Programs

For many years, American-Egyptian cotton (subsequently known as American Pima and extra long staple cotton) was planted by growers as the next best crop on land taken out of production by Upland cotton acreage allotments. Consequently, ELS cotton acreage and production figures were extremely variable through 1949, ranging from a high of 181,000 acres and 75,000 bales in 1942 to a low of 1,500 acres and 1,200 bales in 1947.

Early Farm Programs

In 1942, ELS cotton became a "basic" crop eligible for the first time for Government loans and price support, which previously had been extended only to Upland varieties (14). A CCC purchase program was in effect for the 1942 crop, but the CCC bought less than 6,000 bales because the market price generally exceeded the Government purchase price. Although CCC loans were available for ELS cotton from 1943 through 1949, acreage allotments were removed from Upland cotton after 1943 and the acreage planted to ELS cotton dropped to less than 15,000 acres during 1944-49. When acreage allotments for Upland cotton were reestablished in 1950, the ELS acreage again increased greatly, from 6,000 acres in 1949 to 105,000 acres in 1950. Most producers of ELS cotton also produce Upland cotton. Growers shift from one type to another depending chiefly on expected prices and profits. This shift is facilitated by similarities of production resource requirements and marketing channels in the Southwest and western irrigated valleys where ELS production is best adapted.

ELS purchase programs during the Korean war years of 1951 and 1952 and relatively high support prices thereafter have helped to maintain the U.S. acreage of ELS cotton in the 50,000 to 100,000-acre range in most years since 1950 (app. table 10). Legislation in 1952 provided for a mandatory program comprised of acreage allotments, marketing quotas, and price supports. The price support level was initially based on 90 percent of parity, but by 1960 the support level had dropped to 65 percent of parity (table 55). This drop was in response to the competition from foreign production and manmade fibers and the buildup of CCC inventories.

In 1968, the law was amended to provide for a combination of price support loans with direct payments. The amendment provided a loan level of 150-200 percent of the Upland cotton loan level, with a direct payment to producers required to make up the difference between the loan level and 65 percent of parity. Direct payments were made each year during 1968-76, starting with $3.3 million in crop year 1968 (fiscal year 1969) and ranging from a low of $453,000 in 1976 to a high of $5 million in 1973 (app. table 11).

In late 1979, an amendment dropped the total support level to 55 percent of parity, but the minimum and maximum loan levels were increased to 185 percent and 235 percent, respectively, of the Upland loan level.

The Agriculture and Food Act of 1981 eliminated the direct payment provisions and the tie to parity and dropped the minimum and maximum loan levels to 175 percent and 225 percent, respectively, of the Upland loan level. Marketing quotas and acreage allotments were in effect through crop year 1983. ELS prices were forced down to the loan rate during crop years 1981 and 1982, but market prices had generally exceeded the loan rate for ELS cotton since 1969.

Farmers had planted well below their allotments since 1970, indicating that higher prices were not adequate to compensate for relatively low yields and high production costs.

The 1983 acreage allotment and marketing quota were about one-third less than the levels set for the 1982 crop because of larger carryover stocks and prospects for lower prices.

Recent Programs

USDA attempted unsuccessfully for several years to change the ELS cotton program to a program similar to that for Upland cotton. A bill to do this was introduced in both the House and Senate in 1975. The administration's proposed legislation for the 1977 farm bill included ELS cotton, but the House Committee on Agriculture dropped the measure. These and subsequent efforts by USDA and the Congress culminated in the Extra Long Staple Cotton Act of 1983. This act, which became effective for the 1984 and subsequent crops, eliminated marketing quotas and acreage allotments. It established a minimum loan level at 150 percent of the loan rate for SLM 1-1/16 inch Upland cotton, and provided a target price equal to 120 percent of the ELS base loan rate. The 1983 Act also provided for deficiency payments to ELS producers whenever the average price received by farmers during the first 8 months of the marketing year fell below the target price. The act established an acreage base for each ELS producer equal to the average of acres planted and considered planted to ELS cotton in the 3 crop years immediately preceding the year previous to the year for which the determination is made (for example, 1984 base acreage was the average planted acreage for 1980, 1981, and 1982). The act also authorized an acreage reduction program (ARP) for any ELS cotton crop for which USDA estimated that the supply would otherwise be excessive. Producers had to comply with any announced ARP to be eligible for loans and payments. A paid land diversion program, if needed, would help adjust the national ELS acreage to desirable levels. The act also included ELS cotton in the $50,000 limit on the total deficiency and diversion payments a person could receive under a combination of the rice, wheat, feed grain, Upland cotton, and ELS cotton programs.

The ELS loan rate for 1984 was 82.5 cents per pound, 150 percent of the average Upland loan of 55 cents per pound. The 1984 loan rate was 13.75 cents per pound lower than the 1983 rate. The 1984 target price was 99 cents per pound, or 120 percent of the ELS loan rate. To be eligible for program benefits, producers had to participate in an acreage reduction program and limit their ELS acreage to not more than 90 percent of their acreage base. Deficiency payments in 1984 totaled $747,000, 6.5 cents per pound. Program provisions for the 1985 crop were essentially the same. The loan rate increased to 85.95 cents per pound, and the target price to 103.14 cents per pound. The 1985 crop deficiency payment totaled about $1.3 million, or 14.14 cents per pound. Although domestic use declined in 1984, it rebounded in 1985. Exports increased greatly from previous years.

The Food Security Act of 1985 eliminated the requirement that the ELS cotton loan rate be based on the Upland cotton loan rate. This act specified that the ELS cotton loan rate be equal to 85 percent of the simple average price received by ELS cotton producers during 3 years of the 5-year period ending July 31 in the year in which the loan level is announced, excluding the year in which the average price was the highest and the year in which the average price was the lowest. Other major provisions remain the same as those specified by the 1983 Act.

Table 55--Average price support levels and prices received by farmers for ELS cotton

Crop year	Price support loan 1/	Price support payments 2/	Total support or guarantee 3/	Season average price received by farmers 4/
	Cents per pound			
1960	53.07	0	53.07	55.1
1961	53.18	0	53.18	60.4
1962	53.18	0	53.18	53.9
1963	53.18	0	53.18	52.6
1964	49.25	0	49.25	49.1
1965	49.25	0	49.25	48.1
1966	49.25	0	49.25	48.7
1967	47.00	0	47.00	47.9
1968	40.00	8.69	48.69	40.7
1969	40.00	8.88	48.88	40.4
1970	40.50	9.29	49.79	43.3
1971	38.40	12.69	51.09	44.8
1972	38.50	12.85	51.35	44.9
1973	38.20	16.01	54.21	87.2
1974	49.72	10.86	60.58	64.4
1975	67.74	6.36	74.10	78.9
1976	73.24	1.51	74.75	104.0
1977	76.70	0	76.70	87.9
1978	83.20	0	83.20	91.7
1979	92.95	0	92.95	101.0
1980	93.50	0	93.50	108.0
1981	99.00	0	99.00	96.9
1982	99.89	0	99.89	98.5
1983	96.25	0	96.25	106.0
1984	82.50	6.50	99.00	91.9
1985	85.95	14.14	103.14	90.9
1986	85.40	5/	102.48	5/

1/ Average for all qualities established by law at not less than 65 percent of parity through 1967. For 1968-79, loan level based on 150-200 percent of the Upland base loan level. For 1980 and 1981, the minimum and maximum ELS loan levels were increased to 185 percent and 235 percent, respectively, of the Upland loan rate. For 1982 and 1983, the loan rate was equal to 175 percent of Upland base loan rate. The loan rate for 1984 and 1985 dropped to 150 percent of the Upland base loan rate. For 1986, the loan rate is equal to 85 percent of the simple average price received by producers of ELS cotton during 3 years of the 5-year period ending July 31 in the year in which the loan level is announced.

2/ For 1968-79, payments were required in some years to bring total support equal to 65 percent of parity. For 1980 and 1981, total support had to equal at least 55 percent of parity. No payments were authorized for 1982 and 1983. Deficiency payments for 1984 and 1985 equaled the difference between the target price and the higher of the average market prices received by farmers for the first 8 months of the marketing year or the base loan rate.

3/ No direct payments to producers were made prior to 1968. For the 1968-79 crops, the total support was equal to 65 percent of parity. For 1980-81 crops, total support equaled 55 percent of parity. No payments were authorized in 1982 and 1983. Target prices (120 percent of the ELS loan level) are shown for the 1984, 1985, and 1986 crops.

4/ Includes unredeemed loans.

5/ USDA is prohibited by law from publishing cotton price forecasts.

Source: (23).

The ELS loan rate for 1986 was 85.4 cents per pound and the target price was 102.48 cents per pound. To participate in the 1986 program, producers were required to reduce their acreage of ELS cotton planted for harvest by at least 10 percent from their established acreage base. No advance deficiency payments were made. USDA required neither offsetting compliance nor cross compliance in 1986.

REFERENCES

(1) American Fabrics and Fashion Magazine. Encyclopedia of Textiles. 3d ed. Englewood Cliffs, NJ: Prentice-Hall, 1980.

(2) Brown, H. B., and J. O. Ware. Cotton. 3d ed. New York: McGraw-Hill Book Co., 1958.

(3) Collins, Keith J. "Cotton Price Analysis," Cotton and Wool Outlook and Situation. CWS-28. U.S. Dept. of Agr., Econ. Res. Serv., Aug. 1981.

(4) Glade, Edward H., Jr. "Cotton Marketing Costs Between the Farm and Mill, 1983/84," 1985 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1985.

(5) Glade, Edward H., Jr., Keith J. Collins, and Clarence D. Rogers. Cotton Quality Evaluation: Testing Methods and Use. ERS-668. U.S. Dept. of Agr., Econ. Res. Serv., Nov. 1981.

(6) Glade, Edward H., Jr., and Mae Dean Johnson. Cotton Ginning Charges, Harvesting Practices, and Selected Marketing Costs. U.S. Dept. of Agr., Econ. Res. Serv., annual issues.

(7) Glade, Edward H., Jr., and Mae Dean Johnson. U.S. Cotton Distribution Patterns, 1980/81. SB-696. U.S. Dept. of Agr., Econ. Res. Serv., June 1983.

(8) International Cotton Advisory Committee. Government Regulations on Cotton, 1983. Doc. 11. Washington, DC, Oct. 1983.

(9) Kohel, R. J., and C. F. Lewis, ed. Cotton. Agronomy Monograph No. 24. Madison, WI: American Society of Agronomy, 1984, pp. 233-63.

(10) Lee, Joshua A. "Cotton as World Crop," Cotton. Agronomy Monograph No. 24. Madison, WI: American Society of Agronomy, 1984.

(11) McArthur, W. C., and others. The Cotton Industry in the United States: Farm to Consumer. Pub. No. T-1-186. U.S. Dept. of Agr., Econ., Stat., Coop. Serv., and Texas Tech Univ., Dept. Agr. Econ., Apr. 1980.

(12) McArthur, W. C., and others. U.S. Cotton Production Practices and Costs. Staff Report AGES850422. U.S. Dept. of Agr., Econ. Res. Serv., Aug. 1985.

(13) McElroy, Robert G., and Cole Gustafson. Costs of Producing Major Crops, 1975-81. Staff Report AGES850329. U.S. Dept. of Agr., Econ. Res. Serv., Apr. 1985.

(14) McGowan, Joseph C. History of Extra-Long Staple Cottons. Master's thesis, Univ. of Arizona. Phoenix, AZ: Supima Association of America and Arizona Cotton Growers Association, 1961.

(15) National Cotton Council of America. Cotton Counts Its Customers. Memphis, TN, 1985.

(16) Paarlberg, Phillip L., Alan J. Webb, Arthur Morey, and Jerry A. Sharples. Impacts of Policy on U.S. Agricultural Trade. Staff Report AGES840802. U.S. Dept. of Agr., Econ. Res. Serv., Dec. 1984.

(17) Ramey, H. H., Jr. Ch. 2: "Fiber Crops," Crop Quality, Storage, and Utilization. Madison, WI: American Society of Agronomy, 1980, pp. 35-39.

(18) Rasmussen, Wayne D., ed. A Documentary History of American Agriculture. New York: Random House, 1975.

(19) Sharples, Jerry A., Alan Webb, and Forrest Holland. World Trade and U.S. Farm Policy. Staff Report AGES840521. U.S. Dept. of Agr., Econ. Res. Serv., June 1984.

(20) Starbird, Irving R. "Competition Between Cotton and Other Crops," 1986 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1986.

(21) Strickland, P. L., W. H. Brown, W. C. McArthur, and W. W. Pawson. Cotton Production and Farm Income Estimates Under Selected Alternative Farm Programs. AER-212. U.S. Dept. of Agr., Econ. Res. Serv., Sept. 1971.

(22) Tharp, W. H. The Cotton Plant: How It Grows and Why Its Growth Varies. AH-178. U.S. Dept. of Agr., Agr. Res. Serv., June 1960.

(23) U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service. Extra Long Staple Cotton: Summary of 1985 Support Program and Related Information. ASCS Commodity Fact Sheet. May 1985.

(24) ____________, Economic Research Service. Cotton and Wool Situation and Outlook Yearbook. CWS-46. Aug. 1986.

(25) ____________, Economic Research Service. Cotton: Background for 1985 Farm Legislation. AIB-476. Sept. 1984.

(26) ____________, Economic Research Service. Economic Indicators of the Farm Sector: Costs of Production, 1983. ECIFS 3-1. July 1984.

(27) ____________, Economic Research Service. Economic Indicators of the Farm Sector: Costs of Production, 1985. ECIFS 5-1. Aug. 1986.

(28) ____________, Foreign Agricultural Service. Foreign Agriculture Circular: Cotton. FC-11-86. Nov. 1986.

(29) ____________, Statistical Reporting Service. Agricultural Prices: 1985 Summary. Pr 1-3(86). June 1986.

(30) ____________, Statistical Reporting Service. Agricultural Statistics. Annual issues.

(31) U.S. Department of Commerce, Bureau of the Census. Census of Agriculture. Various issues.

(32) ____________, Bureau of the Census. Census of Manufactures. 1982.

(33) ____________, Bureau of the Census. 1978 Census of Agriculture. Vol. 5, Part 8: 1979 Farm and Ranch Irrigation Survey. Nov. 1982.

(34) ____________, Bureau of the Census. 1982 Census of Agriculture. Vol. 1, Part 51: United States Summary and State Data. Oct. 1983.

(35) ____________, Bureau of the Census. Cotton Ginnings in the United States: Crop of 1984. A30-84. July 1984.

(36) ____________, International Trade Administration, Office of Textiles and Apparel. Foreign Regulations Affecting U.S. Textile Apparel Exports. Special report. Jan. 1985.

(37) U.S. Office of Management and Budget, Statistical Policy Division. Standard Industrial Classification Manual. 1972.

(38) Waddle, B. A. "Crop Growing Practices," Cotton. Agronomy Monograph No. 24. Madison, WI: American Society of Agronomy, 1984, pp. 233-63.

(39) Wilson, David L., and Harry W. Ayer. The Cost of Water in Western Agriculture. Staff Report AGES820706. U.S. Dept. of Agr., Econ. Res. Serv., July 1982.

ADDITIONAL READINGS

Alipoe, Dovi-Akue, Sujit K. Roy, and Don E. Ethridge. "An Economic Analysis of Structural Relationships in U.S. Cotton Sector," 1985 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1985.

Anderson, Carl G. "A Review and Evaluation of Cotton Futures Options Trading," 1985 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1985.

Blakley, Leo V., and Carl E. Shafer. "History of Farm Structure: Cotton," Farm Structure: A Historical Perspective on Changes in the Number and Size of Farms. Com. Print No. 56-2140. U.S. Senate Committee on Agriculture, Nutrition, and Forestry, Apr. 1980.

Brown, Walter, and Terry Townsend. "Nature and Uses of Cotton Futures Options," Cotton and Wool Outlook and Situation Report. CWS-42. U.S. Dept. of Agr., Econ. Res. Serv., Apr. 1985.

Cleveland, O.A., Jr., and Earl A. Stennis. Cotton Marketing and the Cotton Grower. R. R. #122. Mississippi State Univ. and Mississippi Coop. Ext. Serv., July 1981.

Collins, Keith J. "Cotton Comparative Advantage and Policy in the 1980's," 1983 Proceedings, Beltwide Cotton Production Research Conference. Memphis, TN: National Cotton Council of America, 1983.

___________. "Farm Policy for 1985, Past Lessons and Current Problems," 1985 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1985.

___________. "The Effects of Selected Supply and Demand Factors on the U.S. Cotton Market," Cotton and Wool Outlook and Situation Report. CWS-23. U.S. Dept. of Agr., Econ. Res. Serv., May 1980.

___________, Robert B. Evans, and Robert D. Barry. World Cotton Production and Use: Projections for 1985 and 1990. FAER-154. U.S. Dept. of Agr., Econ., Stat., and Coop. Serv., June 1979.

___________, and E. H. Glade, Jr. Cotton in the U.S. Economy: An Interindustry Analysis of International Trade in Cotton and Textiles. Staff Report AGES830119. U.S. Dept. of Agr., Econ. Res. Serv., Feb. 1983.

Colwick, Rex R., William F. Lalor, and Lambert H. Wilkes. "Harvesting," Cotton. Agronomy Monograph No. 24. Madison, WI: American Society of Agronomy, 1984, pp. 367-95.

Encyclopedia of Textiles. 3d ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1980.

Erickson, Milton H., Kenneth C. Clayton, James Johnson, and Keith J. Collins. "Commodity Programs and Policies," Agricultural Food Policy Review: Perspectives for the 1980's. AFPR-4. U.S. Dept. of Agr., Econ. and Stat. Serv., Apr. 1981.

Ethridge, M. Dean. "Trade Policy Issues," 1986 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1986.

Evans, Sam, and Keith J. Collins. "Measuring Farmers' Response to the Cotton Acreage Reduction Program," Cotton and Wool Outlook and Situation Report. CWS-30. U.S. Dept. of Agr., Econ Res. Serv., Mar. 1982.

Evans, Sam. "An Economic Analysis of the 1983 Upland Cotton Program," Cotton and Wool Outlook and Situation Report. CWS-34. U.S. Dept. of Agr., Econ. Res. Serv., Mar. 1983.

___________. "Cotton Farm Program Issues," 1984 Proceedings, Beltwide Cotton Production Research Conference. Memphis, TN: National Cotton Council of America, Jan. 1984.

Firch, Robert S. "Commodity Policy Options: Cotton." Paper presented at Alternative Agricultural and Food Policies and the 1985 Farm Bill Conference, Univ. of California, Berkeley, June 11-12, 1984.

Fox, Austin, Charles V. Moore, and Harold Stults. Production of Surplus Crops on Irrigated Land Served by the U.S. Bureau of Reclamation. Staff Report AGES831213. U.S. Dept. of Agr., Econ. Res. Serv., Feb. 1984.

Glade, Edward H., Jr., and John V. Lawler. "Raw Fiber Equivalent of U.S. Textile Imports by Country of Origin, 1985," Cotton and Wool Situation and Outlook Report. CWS-45. U.S. Dept. of Agr., Econ. Res. Serv., May 1986.

___________. "Recent Trends in U.S. Cotton Textile Imports, by Country and Product Class," Cotton and Wool Outlook and Situation Report. CWS-42. U.S. Dept. of Agr., Econ. Res. Serv., Apr. 1985.

Glaser, Lewrene K. Provisions of the Food Security Act of 1985. AIB-498. U.S. Dept. of Agr., Econ. Res. Serv., Apr. 1986.

Hughes, Dean W. "The Financial Condition of Cotton Farmers," 1986 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1986.

Joseph, Marjory L. Essentials of Textiles. 3d ed. New York: Holt, Rinehart and Winston, 1984.

Knutson, Ronald D. "Cotton Policy: Lessons from the Past and Options for the 1985 Farm Bill," 1984 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1984.

___________, Edward Smith, Carl Anderson, and Mechel Poggi. "International Trade in Cotton: Implications of the 1985 Farm Bill," 1986 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1986.

Lawler, John V. "The Methodology of USDA Textile Trade Data," Cotton and Wool Outlook and Situation Report. CWS-42. U.S. Dept. of Agr., Econ. Res. Serv., Apr. 1985.

Lin, William, James Johnson, and Linda Calvin. Farm Commodity Programs: Who Participates and Who Benefits? AER-474. U.S. Dept. of Agr., Econ. Res. Serv., Sept. 1981.

Penson, J. B., D. W. Hughes, and R. A. Babula. "Impact of Macroeconomic Policy on U.S. Cotton Producers," 1986 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1986.

Skelly, Carol. "Review of the Upland Cotton Acreage Base," Cotton and Wool Outlook and Situation Report. CWS-40. U.S. Dept. of Agr., Econ. Res. Serv., Sept. 1984.

Smith, E. G., J. W. Richardson, and R. D. Knutson. Cost and Pecuniary Economies in Cotton Production and Marketing: A Study of Texas Southern High Plains Cotton Producers. B-1475. Texas A&M Univ. Dept. of Agr. Econ., Aug. 1984.

Starbird, Irving, and Jorge Hazera. "Analysis of Factors Affecting Cotton Yields," Cotton and Wool Outlook and Situation Report. CWS-35. U.S. Dept. of Agr., Econ. Res. Serv., June 1983.

Starbird, Irving R. "The Cotton Program: History, Recent Changes, and Policy Issues," Cotton and Wool Outlook and Situation Report. CWS-42. U.S. Dept. of Agr., Econ. Res. Serv., Apr. 1985.

Stucker, Barbara C., and Keith J. Collins. The Food Security Act of 1985: Major Provisions Affecting Commodities. AIB-497. U.S. Dept. of Agr., Econ. Res. Serv., Jan. 1986.

Tubbs, E. Marty, Cary W. Herndon, Jr., and Earl A. Stennis. Factors Affecting U.S. Cotton Exports to Major Importers. Agr. Econ. Res. Rpt. No. 158. Mississippi State Univ., Dept. of Agr. Econ., Aug. 1985.

Tutwiler, M. Ann, and Terry Townsend. "The Textile and Apparel Trade Enforcement Act of 1985: How Will It Affect Textile Imports?" Cotton and Wool Outlook and Situation Report. CWS-44. U.S. Dept. of Agr., Econ. Res. Serv., Nov. 1985.

U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service. History of Budgetary Expenditures of the Commodity Credit Corporation. Book 1: Fiscal years 1961-79; Book 2: Fiscal years 1980-84. Feb. 1985 (annual updates available).

__________, Economic Research Service. Agricultural Food Policy Review: Commodity Program Perspectives. AER-530. July 1985.

__________, Economic Research Service. A Summary Report on the Financial Conditions of Family-size Commercial Farms. AIB-492. Mar. 1985.

__________, Economic Research Service. Cotton and Wool Outlook and Situation Yearbook. CWS-43. Aug. 1985.

__________, Economic Research Service. History of Agricultural Price-Support and Adjustment Programs, 1933-84. AIB-485. Dec. 1984.

__________, Economic Research Service. Possible Economic Consequences of Reverting to Permanent Legislation or Eliminating Price and Income Supports. AER-526. Jan. 1985.

Wagley, Henry. "China: An Emerging Force in World Cotton Picture," 1986 Proceedings, Beltwide Cotton Production Research Conferences. Memphis, TN: National Cotton Council of America, 1986.

Appendix table 1--U.S. cotton production costs, 1978-85

ITEM	1978	1979	1980	1981	1982	1983	1984	1985
				DOLLARS PER PLANTED ACRE				
CASH RECEIPTS:								
PRIMARY CROP	226.06	316.28	274.16	286.69	319.22	312.23	318.77	327.85
SECONDARY CROP	36.27	49.74	39.62	38.86	35.16	64.82	46.48	31.60
TOTAL	262.33	366.02	313.78	325.55	354.38	377.05	365.25	359.45
CASH EXPENSES:								
SEED	6.18	6.23	6.27	8.30	8.53	8.35	8.96	8.79
FERTILIZER	13.49	14.44	17.79	21.66	25.65	21.25	24.28	23.31
LIME AND GYPSUM	.36	.35	.48	.96	1.14	1.11	1.17	1.20
CHEMICALS	35.27	34.92	37.31	42.27	47.70	48.88	46.73	45.18
CUSTOM OPERATIONS	8.40	8.87	9.81	14.26	15.92	15.46	15.74	16.34
FUEL, LUBE, AND ELECTRICITY	18.42	27.43	35.10	35.19	35.98	32.72	29.42	27.55
REPAIRS	21.71	25.64	28.42	17.37	18.45	19.70	20.02	19.53
HIRED LABOR	11.11	12.63	13.28	10.34	11.17	11.15	11.09	11.69
PURCHASED IRRIGATION WATER	3.50	3.88	3.94	5.41	6.14	6.26	6.37	6.35
GINNING	29.36	41.10	33.48	46.87	49.86	44.95	54.48	57.35
MISCELLANEOUS	0	0	0	1.13	1.29	1.31	1.33	1.33
TECHNICAL SERVICES	0	0	0	1.24	1.70	1.65	1.70	1.71
TOTAL, VARIABLE EXPENSES	147.80	175.49	185.88	205.00	223.53	212.79	221.30	220.33
GENERAL FARM OVERHEAD	12.53	13.28	9.61	20.89	23.88	23.23	24.28	23.67
TAXES AND INSURANCE	8.27	9.28	11.50	9.95	9.33	9.30	9.87	10.02
INTEREST	16.78	18.21	19.86	52.91	54.88	54.76	55.27	52.10
TOTAL, FIXED EXPENSES	37.58	40.77	40.97	83.75	88.09	87.29	89.42	85.80
TOTAL, CASH EXPENSES	185.38	216.26	226.85	288.75	311.62	300.08	310.72	306.12
RECEIPTS LESS CASH EXPENSES	76.95	149.75	86.93	36.80	42.76	76.97	54.53	53.33
CAPITAL REPLACEMENT	34.98	42.74	46.23	38.21	42.58	44.88	45.53	44.47
RECEIPTS LESS CASH EXPENSES AND REPLACEMENT	41.97	107.01	40.70	-1.41	.18	32.09	9.00	8.86
ECONOMIC (FULL OWNERSHIP) COSTS:								
VARIABLE EXPENSES	147.80	175.49	185.88	205.00	223.53	212.79	221.30	220.33
GENERAL FARM OVERHEAD	12.53	13.28	9.61	20.89	23.88	23.23	24.28	23.67
TAXES AND INSURANCE	8.27	9.28	11.50	9.95	9.33	9.30	9.87	10.02
CAPITAL REPLACEMENT	34.98	42.74	46.23	38.21	42.58	44.88	45.53	44.47
ALLOCATED RETURNS TO OWNED INPUTS:								
RETURN TO OPERATING CAPITAL	3.70	5.29	6.80	8.83	7.76	5.80	6.57	5.05
RETURN TO OTHER NONLAND CAPITAL	11.87	14.51	16.75	12.75	14.25	14.93	14.94	14.73
NET LAND RENT	40.77	49.31	43.24	50.55	58.00	62.84	60.45	57.87
UNPAID LABOR	21.58	24.52	25.79	20.07	21.68	21.64	21.53	22.70
TOTAL, ECONOMIC COSTS	281.51	334.42	345.80	366.25	401.01	395.41	404.47	398.84
RESIDUAL RETURNS TO MANAGEMENT AND RISK	-19.17	31.60	-32.02	-40.70	-46.63	-18.36	-39.22	-39.39
TOTAL, RETURNS TO OWNED INPUTS	58.75	125.23	60.56	51.50	55.06	86.85	64.27	60.96
				DOLLARS PER POUND				
HARVEST-PERIOD PRICE	.58	.63	.747	.55	.58	.66	.57	.55
				POUNDS PER ACRE				
YIELD	390.00	502.40	367.19	523.88	550.73	470.40	554.65	591.07

Appendix table 2--Cotton production costs, Southeast, 1978-85

ITEM	1978	1979	1980	1981	1982	1983	1984	1985
	DOLLARS PER PLANTED ACRE							
CASH RECEIPTS:								
PRIMARY CROP	267.94	317.12	271.96	301.61	427.81	269.57	412.84	389.37
SECONDARY CROP	38.25	41.68	31.05	34.95	35.27	52.97	49.64	29.56
TOTAL	306.19	358.80	303.01	336.56	463.08	322.54	462.48	418.93
CASH EXPENSES:								
SEED	6.15	6.12	5.50	5.46	5.23	5.52	6.96	6.48
FERTILIZER	32.81	30.02	40.54	41.68	42.69	40.73	41.99	38.45
LIME AND GYPSUM	3.38	3.75	4.62	6.60	6.72	6.82	6.74	6.43
CHEMICALS	86.34	87.87	93.36	94.31	101.31	105.12	97.45	96.04
CUSTOM OPERATIONS	11.94	12.54	13.82	10.72	11.30	11.55	11.90	11.60
FUEL, LUBE, AND ELECTRICITY	10.06	17.71	24.56	25.94	25.13	21.30	18.87	16.09
REPAIRS	28.88	35.73	41.56	16.55	18.66	19.10	20.32	19.96
HIRED LABOR	7.31	8.74	9.33	7.28	7.57	7.53	7.43	7.61
GINNING	29.65	33.37	24.50	39.56	60.06	33.39	62.18	62.00
MISCELLANEOUS	0	0	0	2.70	1.80	1.83	1.86	1.86
TECHNICAL SERVICES	0	0	0	1.94	2.73	2.72	2.72	2.76
TOTAL, VARIABLE EXPENSES	216.52	235.85	257.79	252.74	283.20	255.61	278.42	269.27
GENERAL FARM OVERHEAD	12.18	11.94	6.17	12.46	17.35	17.40	17.79	17.36
TAXES AND INSURANCE	10.36	12.34	12.38	8.29	8.85	9.38	9.86	10.52
INTEREST	11.76	13.12	14.69	51.25	66.42	67.61	45.30	42.04
TOTAL, FIXED EXPENSES	34.30	37.40	33.24	72.00	92.62	94.39	72.95	69.92
TOTAL, CASH EXPENSES	250.81	273.25	291.03	324.74	375.82	350.00	351.37	339.20
RECEIPTS LESS CASH EXPENSES	55.37	85.55	11.98	11.82	87.26	-27.46	111.11	79.73
CAPITAL REPLACEMENT	46.20	56.42	61.99	46.98	52.00	53.82	56.18	55.37
RECEIPTS LESS CASH EXPENSES AND REPLACEMENT	9.17	29.13	-50.01	-35.16	35.26	-81.28	54.93	24.36
ECONOMIC (FULL OWNERSHIP) COSTS:								
VARIABLE EXPENSES	216.52	235.85	257.79	252.74	283.20	255.61	278.42	269.27
GENERAL FARM OVERHEAD	12.18	11.94	6.17	12.46	17.35	17.40	17.79	17.36
TAXES AND INSURANCE	10.36	12.34	12.38	8.29	8.85	9.38	9.86	10.52
CAPITAL REPLACEMENT	46.20	56.42	61.99	46.98	52.00	53.82	56.18	55.37
ALLOCATED RETURNS TO OWNED INPUTS:								
RETURN TO OPERATING CAPITAL	4.84	6.41	8.68	10.56	8.82	6.99	7.55	5.67
RETURN TO OTHER NONLAND CAPITAL	16.13	19.70	24.46	15.69	17.45	17.79	18.41	18.35
NET LAND RENT	32.66	40.46	40.36	46.21	54.80	47.88	55.39	49.33
UNPAID LABOR	14.18	16.96	18.11	14.12	14.70	14.61	14.41	14.77
TOTAL, ECONOMIC COSTS	353.06	400.07	429.94	407.05	457.16	423.48	458.01	440.65
RESIDUAL RETURNS TO MANAGEMENT AND RISK	-46.88	-41.26	-126.93	-70.49	5.92	-100.94	4.47	-21.72
TOTAL, RETURNS TO OWNED INPUTS	20.93	42.26	-35.32	16.09	101.68	-13.67	100.23	66.41
	DOLLARS PER POUND							
HARVEST-PERIOD PRICE	.595	.647	.79	.57	.58	.67	.58	.55
	POUNDS PER ACRE							
YIELD	450.00	490.40	344.12	528.69	739.39	400.00	713.34	712.22

Appendix table 3--Cotton production costs, Delta, 1978-85

ITEM	1978	1979	1980	1981	1982	1983	1984	1985
				DOLLARS PER PLANTED ACRE				
CASH RECEIPTS:								
PRIMARY CROP	278.91	362.86	301.64	295.46	426.17	359.38	378.68	364.62
SECONDARY CROP	44.27	59.30	41.56	34.50	36.70	70.01	43.97	27.48
TOTAL	323.18	422.16	343.20	329.96	462.87	429.39	422.65	392.10
CASH EXPENSES:								
SEED	5.46	5.47	5.74	6.16	6.20	6.29	8.58	7.98
FERTILIZER	20.78	22.33	28.72	31.36	31.22	30.30	34.60	32.81
LIME AND GYPSUM	.92	1.01	1.28	1.71	1.85	1.86	1.85	1.81
CHEMICALS	58.04	60.43	63.56	71.81	78.42	80.71	75.48	72.27
CUSTOM OPERATIONS	8.65	9.25	10.62	8.72	9.37	9.57	9.62	9.71
FUEL, LUBE, AND ELECTRICITY	10.65	18.73	24.77	28.70	28.38	23.07	18.90	16.40
REPAIRS	32.74	35.22	40.96	18.05	20.92	21.72	22.32	21.90
HIRED LABOR	9.29	10.58	11.35	8.36	9.02	9.08	9.21	9.10
GINNING	32.32	39.11	29.93	37.05	55.09	43.18	57.08	55.55
MISCELLANEOUS	0	0	0	2.59	2.44	2.49	2.54	2.52
TECHNICAL SERVICES	0	0	0	2.45	2.94	2.87	2.87	2.88
TOTAL, VARIABLE EXPENSES	178.85	202.13	216.93	216.96	245.85	231.14	243.05	232.93
GENERAL FARM OVERHEAD	13.01	13.16	8.35	18.83	23.23	23.23	23.67	23.60
TAXES AND INSURANCE	10.49	11.29	11.42	7.91	8.52	9.02	9.42	9.80
INTEREST	17.92	19.50	21.31	45.68	75.89	51.30	63.68	61.44
TOTAL, FIXED EXPENSES	41.42	43.95	41.08	72.42	107.64	83.55	96.77	94.85
TOTAL, CASH EXPENSES	220.27	246.08	258.01	289.38	353.49	314.69	339.82	327.78
RECEIPTS LESS CASH EXPENSES	102.91	176.08	85.19	40.58	109.38	114.70	82.83	64.32
CAPITAL REPLACEMENT	49.03	51.99	57.11	45.66	52.01	53.83	54.14	53.03
RECEIPTS LESS CASH EXPENSES AND REPLACEMENT	53.88	124.09	28.08	-5.08	57.37	60.87	28.69	11.29
ECONOMIC (FULL OWNERSHIP) COSTS:								
VARIABLE EXPENSES	178.85	202.13	216.93	216.96	245.85	231.14	243.05	232.93
GENERAL FARM OVERHEAD	13.01	13.16	8.35	18.83	23.23	23.23	23.67	23.60
TAXES AND INSURANCE	10.49	11.29	11.42	7.91	8.52	9.02	9.42	9.80
CAPITAL REPLACEMENT	49.03	51.99	57.11	45.66	52.01	53.83	54.14	53.03
ALLOCATED RETURNS TO OWNED INPUTS:								
RETURN TO OPERATING CAPITAL	3.68	5.15	6.71	8.65	7.30	5.33	6.35	4.76
RETURN TO OTHER NONLAND CAPITAL	16.51	17.50	21.72	14.72	16.85	17.22	17.28	17.09
NET LAND RENT	51.92	63.03	56.32	55.55	66.20	60.50	63.00	57.52
UNPAID LABOR	18.04	20.54	22.03	16.24	17.51	17.62	17.89	17.65
TOTAL, ECONOMIC COSTS	341.53	384.80	400.59	384.52	437.47	417.89	434.79	416.39
RESIDUAL RETURNS TO MANAGEMENT AND RISK	-18.34	37.36	-57.39	-54.56	25.40	11.50	-12.14	-24.29
TOTAL, RETURNS TO OWNED INPUTS	71.80	143.59	49.39	40.60	133.26	112.17	92.37	72.74
				DOLLARS PER POUND				
HARVEST-PERIOD PRICE	.586	.636	.766	.56	.58	.66	.55	.54
				POUNDS PER ACRE				
YIELD	476.00	570.20	393.76	524.32	732.53	541.26	690.95	671.10

Appendix table 4--Cotton production costs, Southwest, 1978-85

ITEM	1978	1979	1980	1981	1982	1983	1984	1985
	DOLLARS PER PLANTED ACRE							
CASH RECEIPTS:								
PRIMARY CROP	138.53	197.17	140.02	174.06	137.64	172.93	169.33	192.00
SECONDARY CROP	23.94	34.16	20.47	29.09	18.63	41.39	29.27	19.47
TOTAL	162.47	231.34	160.49	203.15	156.27	214.32	198.60	211.47
CASH EXPENSES:								
SEED	6.49	6.51	6.41	9.59	10.23	9.25	9.57	9.55
FERTILIZER	5.38	8.11	8.82	11.80	10.20	8.56	9.93	9.73
CHEMICALS	10.66	10.88	11.61	20.80	21.20	24.14	22.31	21.34
CUSTOM OPERATIONS	3.89	4.01	4.55	7.29	6.51	7.35	7.33	9.00
FUEL, LUBE, AND ELECTRICITY	13.65	20.09	26.45	28.03	26.57	26.14	24.72	23.35
REPAIRS	12.88	15.96	16.76	14.54	14.37	16.14	16.47	16.17
HIRED LABOR	8.66	10.04	10.64	8.34	8.42	8.65	8.49	9.64
PURCHASED IRRIGATION WATER	.10	.08	.10	1.17	1.36	1.39	1.42	1.41
GINNING	21.72	32.03	21.51	35.37	27.24	29.95	35.68	39.66
MISCELLANEOUS	0	0	0	.15	0	0	0	0
TECHNICAL SERVICES	0	0	0	0	.46	.57	.55	.55
TOTAL, VARIABLE EXPENSES	83.43	107.71	106.85	137.08	126.56	132.14	136.47	140.40
GENERAL FARM OVERHEAD	8.18	8.26	8.95	13.20	8.60	9.03	9.11	9.05
TAXES AND INSURANCE	6.57	7.41	6.97	6.31	5.85	6.25	6.30	6.58
INTEREST	13.07	14.23	15.55	32.00	20.68	21.75	19.70	18.89
TOTAL, FIXED EXPENSES	27.82	29.90	31.47	51.51	35.13	37.03	35.11	34.52
TOTAL, CASH EXPENSES	111.25	137.60	138.32	188.59	161.69	169.17	171.58	174.92
RECEIPTS LESS CASH EXPENSES	51.22	93.73	22.17	14.56	-5.42	45.15	27.02	36.55
CAPITAL REPLACEMENT	22.88	30.11	32.31	28.93	28.84	32.57	33.36	32.75
RECEIPTS LESS CASH EXPENSES AND REPLACEMENT	28.34	63.62	-10.14	-14.37	-34.26	12.58	-6.34	3.80
ECONOMIC (FULL OWNERSHIP) COSTS:								
VARIABLE EXPENSES	83.43	107.71	106.85	137.08	126.56	132.14	136.47	140.40
GENERAL FARM OVERHEAD	8.18	8.26	8.95	13.20	8.60	9.03	9.11	9.05
TAXES AND INSURANCE	6.57	7.41	6.97	6.31	5.85	6.25	6.30	6.58
CAPITAL REPLACEMENT	22.88	30.11	32.31	28.93	28.84	32.57	33.36	32.75
ALLOCATED RETURNS TO OWNED INPUTS:								
RETURN TO OPERATING CAPITAL	2.27	3.50	4.55	5.98	4.83	3.87	4.29	3.38
RETURN TO OTHER NONLAND CAPITAL	7.87	10.35	11.34	9.94	9.86	11.07	11.11	11.01
NET LAND RENT	26.45	33.09	21.21	33.92	28.23	38.89	34.74	37.30
UNPAID LABOR	16.81	19.48	20.64	16.19	16.34	16.79	16.48	18.72
TOTAL, ECONOMIC COSTS	174.45	219.91	212.82	251.55	229.11	250.61	251.86	259.19
RESIDUAL RETURNS TO MANAGEMENT AND RISK	-11.98	11.43	-52.33	-48.40	-72.84	-36.29	-53.26	-47.72
TOTAL, RETURNS TO OWNED INPUTS	41.41	77.85	5.41	17.63	-13.58	34.33	13.36	22.69
	DOLLARS PER POUND							
HARVEST-PERIOD PRICE	.521	.566	.697	.48	.51	.60	.52	.53
	POUNDS PER ACRE							
YIELD	266.00	348.60	201.02	362.39	267.63	287.70	322.74	359.34

Appendix table 5--Cotton production costs, West, 1978-85

ITEM	1978	1979	1980	1981	1982	1983	1984	1985
				DOLLARS PER PLANTED ACRE				
CASH RECEIPTS:								
PRIMARY CROP	447.62	682.36	784.60	697.48	671.15	742.88	678.84	708.57
SECONDARY CROP	71.50	97.35	117.82	83.63	80.88	142.72	104.73	80.80
TOTAL	519.12	779.71	902.42	781.11	752.03	885.60	783.57	789.37
CASH EXPENSES:								
SEED	6.09	6.09	6.67	7.45	7.68	9.13	8.34	8.57
FERTILIZER	27.89	24.95	32.10	38.36	57.69	45.40	48.94	47.98
LIME AND GYPSUM	0	0	0	1.59	1.68	1.78	1.86	1.90
CHEMICALS	80.19	81.43	88.16	63.53	67.33	69.91	64.13	60.52
CUSTOM OPERATIONS	23.96	25.63	28.91	49.92	53.02	52.91	53.48	54.18
FUEL, LUBE, AND ELECTRICITY	50.09	67.36	88.00	74.94	76.45	72.75	64.16	64.98
REPAIRS	36.86	48.20	54.53	27.42	27.01	29.43	28.01	27.18
HIRED LABOR	24.10	25.71	28.02	21.84	23.05	23.92	23.70	24.77
PURCHASED IRRIGATION WATER	22.37	23.54	26.35	31.18	33.26	33.89	34.51	34.35
GINNING	53.75	79.34	90.12	107.19	105.17	103.26	108.66	118.83
MISCELLANEOUS	0	0	0	2.21	3.93	4.00	4.07	4.05
TECHNICAL SERVICES	0	0	0	4.00	3.34	3.33	3.33	3.33
TOTAL, VARIABLE EXPENSES	325.30	382.25	442.86	429.63	459.60	449.71	443.19	450.64
GENERAL FARM OVERHEAD	29.59	35.59	15.16	56.02	70.98	74.27	76.81	77.16
TAXES AND INSURANCE	10.91	13.15	29.85	27.32	20.56	20.18	22.13	21.96
INTEREST	31.95	34.36	37.12	143.35	122.94	168.45	161.91	156.55
TOTAL, FIXED EXPENSES	72.45	83.09	82.13	226.69	214.48	262.90	260.85	255.68
TOTAL, CASH EXPENSES	397.75	465.34	524.99	656.32	674.08	712.61	704.04	706.32
RECEIPTS LESS CASH EXPENSES	121.37	314.37	377.43	124.79	77.95	172.99	79.53	83.05
CAPITAL REPLACEMENT	56.85	75.74	83.01	59.81	67.11	71.74	68.25	66.22
RECEIPTS LESS CASH EXPENSES AND REPLACEMENT	64.52	238.63	294.42	64.98	10.84	101.25	11.28	16.83
ECONOMIC (FULL OWNERSHIP) COSTS:								
VARIABLE EXPENSES	325.30	382.25	442.86	429.63	459.60	449.71	443.19	450.64
GENERAL FARM OVERHEAD	29.59	35.59	15.16	56.02	70.98	74.27	76.81	77.16
TAXES AND INSURANCE	10.91	13.15	29.85	27.32	20.56	20.18	22.13	21.96
CAPITAL REPLACEMENT	56.85	75.74	83.01	59.81	67.11	71.74	68.25	66.22
ALLOCATED RETURNS TO OWNED INPUTS:								
RETURN TO OPERATING CAPITAL	8.66	11.90	15.49	19.31	16.49	12.63	13.90	10.94
RETURN TO OTHER NONLAND CAPITAL	18.96	25.26	29.52	19.60	22.59	24.06	22.60	22.11
NET LAND RENT	85.88	103.27	116.01	108.21	134.51	154.00	141.91	133.31
UNPAID LABOR	46.77	49.90	54.40	42.39	44.73	46.43	45.99	48.07
TOTAL, ECONOMIC COSTS	582.92	697.06	786.30	762.29	836.57	853.02	834.78	830.42
RESIDUAL RETURNS TO MANAGEMENT AND RISK	-63.80	82.65	116.12	18.82	-84.54	32.58	-51.21	-41.05
TOTAL, RETURNS TO OWNED INPUTS	96.47	272.99	331.54	208.33	133.78	269.70	173.20	173.38
				DOLLARS PER POUND				
HARVEST-PERIOD PRICE	.626	.680	.772	.61	.63	.72	.65	.59
				POUNDS PER ACRE				
YIELD	715.00	1,003.60	1,016.29	1,136.00	1,073.72	1,028.17	1,044.56	1,205.64

Appendix table 6--Acreage, yield, and production of Upland cotton

Year	Planted	Harvested	Diverted	Yield per harvested acre	Production
	Million acres			Pounds	1,000 bales 1/
1950	18.8	17.7	NA	269	9,848
1951	29.3	26.9	NA	270	15,030
1952	28.0	25.8	NA	280	14,861
1953	26.8	24.2	NA	324	16,253
1954	20.0	19.2	NA	341	13,578
1955	17.9	16.9	NA	417	14,501
1956	17.0	15.6	2/ 1.1	408	13,102
1957	14.2	13.5	2/ 3.0	387	10,801
1958	12.3	11.8	2/ 4.9	465	11,353
1959	15.8	15.1	NA	461	14,446
1960	16.0	15.2	NA	446	14,199
1961	16.5	15.6	NA	438	14,263
1962	16.2	15.5	NA	456	14,754
1963	14.7	14.1	NA	516	15,129
1964	14.7	13.9	.5	517	15,025
1965	14.1	13.5	1.0	527	14,850
1966	10.3	9.5	4.6	480	9,484
1967	9.4	7.9	4.8	446	7,374
1968	10.8	10.1	3.3	516	10,847
1969	11.8	11.0	NA	433	9,913
1970	11.9	11.1	NA	439	10,135
1971	12.3	11.4	2.1	438	10,379
1972	13.9	12.9	2.0	507	13,608
1973	12.4	11.9	NA	521	12,896
1974	13.6	12.5	NA	441	11,450
1975	9.4	8.7	NA	453	8,247
1976	11.6	10.9	NA	464	10,517
1977	13.6	13.2	NA	519	14,277
1978	13.3	12.3	.3	419	10,762
1979	13.9	12.7	NA	547	14,531
1980	14.5	13.1	NA	402	11,018
1981	14.3	13.8	NA	542	15,566
1982	11.3	9.7	3/ 1.6	589	11,864
1983	7.9	7.3	4/ 6.6	506	7,677
1984	11.1	10.3	3/ 2.5	599	12,852
1985	10.6	10.1	5/ 3.6	628	13,277

NA = Not applicable.
1/ 480-pound net-weight bales.
2/ Includes cotton acreage placed in acreage reserve program of the Soil Bank.
3/ Acreage reduction program (ARP).
4/ Includes 4.1 million acres in PIK program and 2.5 million acres in other acreage reduction programs.
5/ 2.3 million acres ARP and 1.3 million acres paid land diversion (PLD).

Source: (24).

Appendix table 7--Use and ending stocks for Upland cotton

Crop year	Mill use	Exports	Total use	Ending stocks	Stocks-to-use ratio
	1,000 bales 1/				Percent
1950	10,355	4,108	14,443	2,196	15
1951	9,117	5,515	14,632	2,741	19
1952	9,358	3,048	12,406	5,511	44
1953	8,475	3,760	12,235	9,570	78
1954	8,730	3,445	12,175	11,028	91
1955	9,085	2,194	11,279	14,553	129
1956	8,459	7,856	16,314	11,388	70
1957	7,975	5,949	13,924	8,666	62
1958	8,683	2,870	11,553	7,776	76
1959	8,888	7,393	16,281	7,410	46
1960	8,122	6,850	14,972	7,073	47
1961	8,756	5,049	13,805	7,717	56
1962	8,322	3,426	11,748	10,390	93
1963	8,554	5,773	14,327	12,091	84
1964	9,107	4,174	12,281	13,980	105
1965	9,454	3,029	12,483	16,734	134
1966	9,438	4,819	14,257	12,081	85
1967	8,948	4,316	13,264	6,379	48
1968	8,204	2,816	11,020	6,377	58
1969	8,001	2,863	10,864	5,727	53
1970	8,105	3,885	11,990	4,134	34
1971	8,163	3,376	11,539	3,182	28
1972	7,670	5,306	12,976	4,153	32
1973	7,384	6,111	13,495	3,753	28
1974	5,797	3,914	9,711	5,649	58
1975	7,160	3,300	10,438	3,615	35
1976	6,595	4,779	11,375	2,879	25
1977	6,416	5,459	11,874	5,278	44
1978	6,286	6,150	12,435	3,905	31
1979	6,440	9,177	15,617	2,962	19
1980	5,828	5,893	11,721	2,614	22
1981	5,216	6,555	11,771	6,567	56
1982	5,457	5,194	10,651	7,844	74
1983	5,861	6,750	12,611	2,693	21
1984	5,491	6,125	11,616	4,024	35
1985	6,338	1,855	8,193	9,289	113

1/ 480-pound net-weight bales.

Source: (24).

Appendix table 8--Prices and ending stocks for Upland cotton

Crop year 1/	Ending stocks: CCC-owned	Ending stocks: Free 2/	Ending stocks: Total	Average price received 3/	Loan rate 4/	Target price	Direct payment
	1,000 bales			Cents per pound			
1950	76	2,120	2,196	39.90	30.25	NA	NA
1951	2	2,739	2,741	37.69	32.36	NA	NA
1952	236	5,275	5,511	34.17	32.41	NA	NA
1953	129	9,441	9,570	32.10	33.50	NA	NA
1954	1,661	9,367	11,028	33.52	34.03	NA	NA
1955	5,952	8,601	14,553	32.27	34.55	NA	NA
1956	4,829	6,559	11,388	31.63	32.74	NA	NA
1957	937	7,729	8,666	29.46	32.31	NA	NA
1958	984	7,792	8,776	33.09	35.08	NA	NA
1959	4,967	2,443	7,410	31.56	34.10	NA	NA
1960	1,678	5,395	7,073	30.08	32.42	NA	NA
1961	1,449	6,155	7,604	32.80	33.04	NA	NA
1962	3,750	6,640	10,390	31.74	32.47	NA	NA
1963	4,303	7,788	12,091	32.02	32.47	NA	NA
1964	6,557	7,423	13,980	29.62	30.00	NA	5/3.50
1965	9,715	7,019	16,734	28.03	29.00	NA	4.35
1966	6,677	5,404	12,081	20.64	21.00	NA	9.42
1967	552	5,827	6,379	25.39	20.25	NA	11.53
1968	24	6,353	6,377	22.02	20.25	NA	12.24
1969	1,890	3,837	5,727	20.94	20.25	NA	14.73
1970	262	3,872	4,134	21.86	20.25	NA	16.80
1971	1	3,181	3,182	28.07	19.50	NA	6/5.00
1972	0	4,153	4,153	27.20	19.50	NA	15.00
1973	0	3,753	3,753	44.40	19.50	NA	15.00
1974	0	5,649	5,649	42.70	27.06	38.00	7/0
1975	0	3,615	3,615	51.10	36.12	38.00	0
1976	0	2,879	2,879	63.80	38.92	43.20	0
1977	8/	5,278	5,278	52.10	44.63	47.80	0
1978	8/	3,905	3,905	58.10	48.00	52.00	0
1979	8/	2,962	2,962	62.30	50.23	57.70	0
1980	8/	2,614	2,614	74.40	48.00	58.40	0
1981	1	6,566	6,567	54.00	52.46	70.87	7.67
1982	396	7,448	7,844	59.10	57.08	71.00	13.92
1983	158	2,535	2,693	66.00	55.00	76.00	12.10
1984	123	3,901	4,024	57.50	55.00	81.00	18.60
1985	735	8,554	9,289	54.40	57.30	81.00	23.70

NA = Not applicable.

1/ Crop year beginning August 1. 2/ Includes ending stocks (July 31) of cotton in consuming establishments, public storage (including cotton under loan but excluding CCC-owned cotton) compresses, and cotton in transit.

3/ Season-average prices received by farmers for lint cotton, including an allowance for unredeemed loans. 4/ Loan rates shown for 1950-73 are basis Middling 1-inch, micronaire 3.5-4.9. Loan rates shown for 1974-85 are basis Strict Low Middling 1-1/16 inch, micronaire 3.5-4.9. 5/ From 1964-70, price support payments were available on the domestic allotment (67 percent of total allotment in 1964, 65 percent in 1965-70). Loans were available on the entire production within the allotment. 6/ From 1971-73, the direct payment represents the minimum payment rate available on the full base acreage allotment. Payments in 1971-72 were contingent on participation in the cropland set-aside program, while no set-aside requirement was imposed for 1973. 7/ From 1974-85, the direct payments represent deficiency payments--the difference between the target price and the higher of the calendar year average price or the base loan rate. Diversion payments, disaster payments, and PIK entitlements are excluded. 8/ Fewer than 500 bales.

Source: (25).

Appendix table 9--Farm-related program costs for Upland cotton 1/

Fiscal year	Direct price support or deficiency	Diversion	Disaster	Export 2/	Equalization	Loan operations		Net price support and related expenditures 3/
						Outlays	Repayments	
	Million dollars							
1961	---	---	---	191.9	---	1,288.2	58.3	197.8
1962	---	---	---	174.3	---	800.6	223.1	682.0
1963	---	---	---	121.1	---	1,068.9	360.2	796.2
1964	---	---	---	40.0	62.6	1,266.4	287.9	569.6
1965	51.2	---	---	4.4	435.0	1,051.6	362.1	752.1
1966	57.6	6.4	---	---	332.2	958.1	256.4	930.1
1967	489.2	303.4	---	---	20.4	287.3	148.8	216.5
1968	610.8	244.3	---	---	---	137.2	108.1	193.5
1969	639.5	96.3	---	---	---	447.9	179.0	957.6
1970	797.6	18.7	---	---	---	383.0	247.6	891.4
1971	890.0	24.9	---	---	---	247.2	263.7	603.2
1972	819.3	.1	---	---	---	106.6	115.4	760.4
1973	808.7	.1	---	---	---	170.3	165.3	824.0
1974	713.2	.1	---	---	---	163.1	154.8	724.6
1975	---	.1	127.0	---	---	292.7	189.9	232.8
1976 4/	---	---	124.7	---	---	105.8	237.3	-4.0
1977	---	---	95.2	---	---	168.5	159.3	104.3
1978	5/	16.8	72.8	---	---	934.3	799.9	223.8
1979	5/	23.6	189.2	---	---	332.8	404.4	141.2
1980	5/	---	104.0	---	---	401.5	441.6	64.3
1981	5/	.1	303.9	---	---	522.6	491.6	335.7
1982	467.4	.1	99.9	---	---	1,394.7	770.1	1,189.7
1983	6/ 804.2	3.3	105.5	---	---	1,363.3	958.5	1,362.9
1984	145.1	7/ -1.1	0.5	---	---	1,431.8	1,282.1	244.1
1985	1,048.4	161.8	---	---	---	808.6	449.2	1,552.7
1986	904.6	34.1	---	---	---	1,940.2	695.8	2,213.5

--- = No outlays.

1/ Excludes P.L. 480 commodity costs. 2/ Commodity export payments. 3/ Direct price support or deficiency, diversion, disaster, export, or equalization payments plus Government expenditures on transportation, classing, loans, loan settlements, and other expenses less sale proceeds, loan repayments, and other receipts. Negative indicates net receipts. 4/ Includes July-Sept. 1976 to allow for shift from July/June to Oct./Sept. fiscal year. 5/ Net receipts of less than $1 million. 6/ Includes advance on 1983 crop deficiency payment. 7/ Reflects adjustment for advanced diversion payments made in fiscal year 1983 prior to PIK program.

Source: Budget Division, Agricultural Stabilization and Conservation Service, USDA.

Appendix table 10--Supply and use of ELS cotton

Crop year 1/	Allotment	Planted	Yield per harvested acre	Production	Imports	Mill use	Exports	Ending stocks
	1,000 acres		Pounds	1,000 bales 2/				
1950	NA	105	298	62	121	152	3/	82
1951	NA	65	354	46	46	79	3/	48
1952	NA	108	425	94	132	103	3/	94
1953	NA	94	340	64	92	101	3/	158
1954	41	37	589	41	98	112	3/	177
1955	46	44	500	42	86	125	20	133
1956	45	44	583	50	93	114	57	54
1957	89	84	485	82	45	101	10	124
1958	83	80	525	83	86	110	25	155
1959	71	68	513	70	83	138	2	157
1960	65	63	535	67	86	149	8	140
1961	64	62	503	62	84	173	7	95
1962	100	96	576	112	82	162	3	206
1963	150	144	562	164	81	142	2	260
1964	112	110	536	120	83	154	21	269
1965	78	77	563	88	88	142	6	294
1966	81	80	447	72	76	136	13	263
1967	70	68	502	70	91	129	45	205
1968	70	68	565	79	30	128	9	167
1969	80	78	493	77	22	113	15	116
1970	78	76	369	57	26	99	12	69
1971	118	102	466	98	30	96	9	76
1972	118	98	480	96	11	99	5	68
1973	118	85	451	78	21	88	12	55
1974	118	84	526	90	10	63	12	59
1975	91	69	397	54	56	90	11	66
1976	84	46	692	64	19	79	5	49
1977	120	75	724	112	4	67	25	69
1978	92	77	590	93	2	66	30	53
1979	115	91	531	99	1	66	52	38
1980	132	72	698	104	1	63	33	54
1981	150	59	659	80	8	48	12	65
1982	120	71	672	99	8	56	13	93
1983	80	63	725	95	4	67	36	82
1984	NA	80	786	130	3	49	90	78
1985	NA	84	891	155	0	61	105	59

NA= Not applicable.
1/ Year beginning August 1.
2/ Prior to 1956, all cotton in running bales. Beginning 1956, all cotton in 480-pound net-weight bales.
3/ Fewer than 500 bales.

Source: (23).

Appendix table 11--Farm-related program costs for ELS cotton 1/

Fiscal year	Direct price support	Loan operation: Outlays	Loan operation: Repayments	Net price support and related expenditures 2/
	Million dollars			
1961	---	2.8	3.0	-6.8
1962	---	4.4	3.0	-7.6
1963	---	11.4	5.9	5.6
1964	---	31.0	5.0	26.3
1965	---	12.8	7.3	-2.0
1966	---	9.4	2.5	4.1
1967	---	9.3	3.5	1.0
1968	---	7.3	2.3	-3.0
1969	3.3	5.6	3.8	.5
1970	3.3	7.0	6.3	-3.1
1971	2.6	5.1	4.6	-5.9
1972	4.6	7.5	4.9	5.1
1973	4.7	6.5	8.9	-1.8
1974	5.0	4.0	4.2	4.7
1975	3.8	10.9	4.8	9.9
1976 3/	1.6	3.4	10.6	-5.8
1977	.5	3.8	3.8	.5
1978	---	18.1	12.1	6.9
1979	---	14.1	15.2	-1.1
1980	---	18.4	21.8	-3.4
1981	---	24.5	15.4	9.1
1982	---	27.9	13.6	14.3
1983	---	28.9	21.1	8.2
1984	---	19.7	18.8	-16.3
1985	.7	8.4	6.3	-4.6
1986	1.3	14.4	12.8	1.7

--- = No outlays.

1/ Excludes P.L. 480 commodity costs.

2/ Direct price support or deficiency, diversion, disaster, export, or equalization payments plus Government expenditures on transportation, classing, loans, loan settlements, and other expenses less sale proceeds, loan repayments, and other receipts. Negative indicates net receipts.

3/ Includes July-Sept. 1976 to allow for shift from July/June to Oct./Sept. fiscal year.

Source: Budget Division, Agricultural Stabilization and Conservation Service, USDA.

Acreage allotment. The individual farm's share, based on its production history, of the national acreage considered desirable as a means of adjusting supplies of a particular crop to national needs. Allotments were historically used with marketing quotas, which ended with the establishment of voluntary cotton programs in the early 1970's. The Food and Agriculture Act of 1977 ended the historical allotments and bases that had traced back to the 1950's and 1960's. The program acreages used for payment purposes since 1978 have been based on recent plantings.

Agricultural Stabilization and Conservation Service (ASCS). The USDA agency that carries out several principal farm commodity programs from appropriated funds, including Commodity Credit Corporation (CCC) program activities.

Bale. A package of compressed cotton lint as it comes from the gin. Including bagging and ties, a bale weighs about 500 pounds, and its dimensions vary depending on the degree of compression, 12-32 pounds per cubic foot. A bale is the form in which cotton moves in domestic and international commerce. However, cotton is bought and sold on a net weight (pound or kilogram) basis. For statistical purposes, cotton is reported in terms of running bales, in 480-pound net weight bales, or in pounds. A running bale is any bale of varying lint weight as it comes from the gin. To maintain comparability, bale weights are commonly converted to 480-pound net weight equivalents.

Basic commodities. Agricultural products, including corn, cotton, peanuts, rice, tobacco, and wheat, that are designated by legislation as price-supported commodities.

Blending. The mixing of other fibers with cotton. The resulting textile product is a compromise of unique properties or characteristics of the fibers in the blend, often providing a superior end product in some uses.

Boll. The seed pod of the cotton plant.

Bonded warehouse. A warehouse owned by persons approved by the U.S. Treasury Department, and under bond or guarantee for the strict observance of the revenue laws; used for storing goods until duties are paid or goods are otherwise released.

Carding. A process in yarn manufacturing by which fibers are sorted, separated, partially aligned, and cleaned of foreign matter.

Cargo Preference Act. A U.S. law which provides that "whenever the United States contracts for, or otherwise obtains for its own account, or furnishes to or for the account of any foreign nation without provision for reimbursement, any equipment, materials or commodities," the United States shall ship in U.S. flag vessels, to the extent that they are available at fair and reasonable rates, at least 50 percent of the gross tonnage involved.

Carryover stocks. The quantity of a commodity which is available for marketing at the beginning of a marketing year or crop year. "Beginning stocks" of cotton are frequently reported for the marketing year beginning August 1. "Ending stocks" reflect supply less disappearance, adjusted for any unaccounted cotton, for the year ending July 31.

Cellulosic fibers. All fiber of plant or vegetable origin. These fibers include natural fibers such as cotton, linen, and jute, and manmade fibers of woodpulp origin, such as rayon and acetate.

Cloth. A textile product obtained by weaving, knitting, braiding, felting, bonding, or fusing of fibers. Cloth is synonymous with "fabric."

Commodity Credit Corporation (CCC). The USDA agency responsible for directing and financing major USDA "action programs," including price support, production stabilization, commodity distribution, and related programs. CCC also directs and finances certain agricultural export activities. CCC activities are implemented by the Agricultural Stabilization and Conservation Service.

Conserving use. An approved cultural practice or use of land authorized by the county Agricultural Stabilization and Conservation Service on cropland required to be diverted under production adjustment or conservation programs.

Corduroy. A pile-filling fabric with ridges of pile running lengthwise, creating a ribbed surface.

Cost, insurance, and freight (c.i.f.). A term usually used in reference to ocean shipping which defines the seller's price to include the cost of goods, marine insurance, and transportation (freight) charges to the point of destination.

Cotton. A soft, white vegetable (cellulosic) fiber obtained from the seed pod of the cotton plant, a member of mallow family (Gossypium). Cotton is produced in about 75 countries. The two principal types of cotton grown in the United States are Upland cotton (Gossypium hirsutum) and American Pima cotton (Gossypium barbadense). Upland cotton is grown throughout the Cotton Belt, accounting for about 99 percent of U.S. cotton production.
The types of cotton grown, or once grown, in the United States are as follows:

Upland cotton. The predominant type of cotton grown in the United States and in most major cotton producing countries of the world. The staple length of these fibers ranges from about 3/4 inch to 1-1/4 inch, averaging nearly 1-3/32 inches.

Extra long staple cotton (ELS). Cottons having a staple length of 1-3/8 inches or more, according to the classification used by the International Cotton Advisory Committee. Also characterized by fineness and high fiber strength, contributing to finer and stronger yarns, needed for certain end-uses such as thread and higher valued fabrics. American growths include American Pima and, formerly, Sea Island cotton.

(a) American-Pima cotton. An extra long staple cotton formerly known as American-Egyptian cotton in the United States, grown chiefly in the irrigated valleys of Arizona, New Mexico, and West Texas. Represents only 1 percent of the U.S. cotton crop. Used chiefly for thread and high-valued fabrics and apparel. Came into existence as the Sea Island cotton was becoming extinct in the United States.

(b) Sea Island cotton. An extra long staple cotton first grown in the United States about 1786 from seed received from the Bahama Islands. Relatively unimportant as a commercial crop until the 19th century. Produced in the coastal areas of South Carolina, Georgia, and Florida until the early 1920's, when U.S. production virtually ceased because of increasing competition from foreign growths of ELS cotton, the growing American-Egyptian cotton industry in the Western States, and production problems associated with Sea Island cotton. Commonly about 1-1/2 inches in length but ranged up to 2 inches.

Cotton Board (CB). A quasi-governmental organization whose members are appointed by the Secretary of Agriculture from nominees of cotton producer organizations. Established in 1967 by the Cotton Research and Promotion Act, the board receives and disburses grower assessments to finance the Cotton Incorporated program.

Cotton compress. The equipment which forms the ginned raw cotton into a bale. The first compression, primarily to modified flat or universal bale dimensions, is performed at the gin. Further compression of flat or modified flat bales is performed at cotton warehouse locations.

Cotton Council. See National Cotton Council of America.

Cotton Council International (CCI). The overseas operations service of the National Cotton Council of America. Established in 1956, CCI's primary objective is to develop markets for U.S. exports. CCI programs are operated in close cooperation with the Foreign Agricultural Service, USDA, and trade groups in the United States and abroad. Headquartered in Washington, DC.

Cotton count. (1) For yarn, a numbering system based on the number of 840-yard lengths in a pound. The higher the number the finer the yarn. A single strand of #10 yarn is expressed as 10s or 10/1. A 10s yarn has 8,400 yards to the pound; a pound of 20s yarn is 16,800 yards long. (2) For woven cloth, the number of warp ends and filling picks per inch. If a cloth is 68x72, there are 68 ends and 72 picks per inch in the fabric. An end is a warp yarn or thread that runs lengthwise or vertically in cloth. The ends interlace at right angles with filling yarn (picks) to make woven fabric. (3) For knitted fabric, count indicates the number of wales and courses per inch. A course is a crosswise row of loops or stitches, similar to the filling of woven fabric. A wale is a lengthwise series of loops in a knitted fabric.

Cotton exchange. A membership organization which provides facilities where cotton futures contracts are bought and sold. As of 1986, there were two such exchanges: the New York Cotton Exchange and the Chicago Rice and Cotton Exchange. The basis grade for the New York contract is Strict Low Middling 1-1/16-inch cotton; the basis grade for that of the Chicago contract is Strict Low Middling Light Spotted 31/32-inch cotton, largely produced in Texas and Oklahoma.

Cotton Incorporated (CI). A private corporation established in 1971 as the sales-oriented marketing and research organization representing U.S. cotton growers. CI's objectives are to increase producer's profits and to expand the sale of products containing cotton. Headquartered in New York City.

Cotton quality. Three major components of cotton quality--grade, staple, and micronaire--are included in official USDA cotton quality classifications. Added fiber properties, including length uniformity and strength, are also recognized as important and are increasingly being measured by instrument testing. Instruments are gradually replacing sight and touch methods in measuring cotton quality. Grade depends on the color, trash content, and preparation (smoothness) of the cotton sample. There are 44 Upland cotton grades and 10 grades of extra long staple cotton. The Official Cotton Standards of the United States for the grade of American Upland cotton, also called Universal Standards, are periodically renewed and approved by major foreign cotton-consuming countries. Thirty-one official standards exist for U.S. cotton staple, ranging from less than 13/16 inch to 1-3/4 inches. Micronaire is an airflow measurement that indicates fiber fineness and maturity.

Cottonseed. The seed of cotton from which the lint has been removed. Cottonseed oil is extracted from the seed through a crushing process. Cottonseed meal and cottonseed hulls, coproducts from the seed-crushing operation, are used as livestock feed.

Cotton system. A process originally used to manufacture cotton fiber into yarn and now used extensively for producing spun yarns of manmade fibers, including blends. The major manufacturing steps in the cotton system include opening of the fiber bales, picking, carding, drawing, roving, and spinning. The combing step is included after carding when combing yarns are made.

Crop year. The year in which a crop is planted. Also the cotton marketing year, which is the year beginning August 1 and ending July 31.

Cross compliance. When a full cross-compliance program is in effect, a producer participating in one commodity program (wheat, feed grains, cotton, or rice) on a farm must also participate on that farm in any of the other commodity programs. When a limited cross-compliance program is in effect, a producer participating in one commodity program must not plant in excess of the crop acreage base on that farm for any of the other program commoditites for which an acreage reduction program is in effect.

Deficiency payment. A direct Government payment to participating producers if farm average prices fall below specified target price levels during the calendar year. Payment rates cannot exceed the difference between target prices and price support loans.

Delinting. The process of separating the very short fibers ("linters") remaining on the seed after the longer fiber has been removed in the ginning process.

Denier. A metric system method of measuring fibers. It is the weight in grams of 9,000 meters of the fiber.

Denim. A relatively heavy, yarn-dyed twill fabric traditionally made of cotton with colored warp yarns and undyed fill yarns. Most denim fabric is used to make trousers.

Disappearance. U.S. textile mill raw fiber consumption plus raw fiber exports.

Disaster payments. Government payments to participating producers who are prevented from planting any portion of their permitted acreage under a program, or who suffer low yields, due to weather and related conditions. Starting in 1982, disaster payments, as a rule, were available only to those producers who had no access to Federal crop insurance.

Diversion payments. Government payments made to farmers in some years for not planting a specified portion of crop-acreage base or permitted acreage. A specified acreage is usually diverted to soil conserving uses.

Domestic consumption. U.S. mill raw fiber consumption plus raw fiber equivalent of imported textiles, less raw fiber equivalent of exported textiles.

Durable press. Performance characteristics of treated textile products, mostly apparel. These features generally involve easy care: shape retention, machine washability, tumble-dry, little or no ironing, and the like. Often referred to as "permanent press" or "wash and wear."

End. A warp yarn or thread that runs lengthwise or vertically in the fabric. Ends interlace at right angles with filling yarn (picks) to make woven fabric.

End-use. The final product form in which fibers are consumed, including apparel, household products, and industrial items.

Extra-long staple. See Cotton.

Fabric. See Cloth.

Face. The side of a fabric which, by reason of weave, finish, or other characteristic, presents a better appearance than the other side, or back.

Fiber. A slender strand of natural or manmade material usually having a length at least 100 times its diameter and characterized by flexibility, cohesiveness, and strength. Several strands may be combined for spinning, weaving, and knitting purposes. Cotton fibers are known as staple fibers since their length varies within a relatively narrow range from about 7/8 inch to 1-3/4 inches. Manmade fiber filaments are often cut to blend or mix with cotton for further processing on the cotton system.

Filament. An individual strand of fiber indefinite in length. Manmade fibers are indefinite in length. Silk is the only natural fiber available in filament form. Silk may run several hundred yards in length.

Filling. An individual yarn which interlaces with warp yarn at right angles in woven fabric. Also known as pick or filling pick. Usually has less twist than warp yarn, which runs lengthwise in the fabric.

Finishing. Those processes through which a fabric passes after being taken from the loom, such as bleaching, dyeing, sizing, lacquering, waterproofing, and removing defects.

Forward contract. Sale of a commodity from a future crop for future delivery. The sale could involve all of the crop from a given contract acreage or, more commonly, a given quantity of specified quality.

Gin. A machine that separates cotton lint from seed and removes most of the trash and foreign matter from the lint. The lint is cleaned, dried, and compressed into bales weighing approximately 500 pounds, including wrapping and ties. There are about 2,000 gins located throughout the Cotton Belt.

Grade. See Cotton quality.

Gray or greige fabric. Woven or knitted goods direct from the loom or knitting machine, before they have been given any kind of finishing treatment.

Group "B" mill price. See Price, raw cotton.

Hand. A subjective measurement of the reaction obtained from the sense of touch created when handling a fabric, reflecting the many factors which lend individuality and character to a material.

Hard fibers. Comparatively stiff, elongated, woody fibers from the leaves or leaf stems of certain perennial plants. These fibers are generally too coarse and stiff to be woven and are used chiefly in twine, netting, and ropes. Examples are abaca, sisal, and henequen. See Soft fibers.

Hedging. The practice of buying or selling futures contracts to offset an existing position in the cash or spot market, thus reducing the risks of unforeseen major price changes.

High density. The compression of a flat, modified flat, or gin standard bale of cotton to high density of about 32 pounds per cubic foot. Previously used for most exported cotton, but currently replaced by universal density compression of about 28 pounds per cubic foot.

Import quota. The maximum amount of a commodity that can be imported in a specified time period. The United States imposes an annual import quota on raw cotton totaling 14.5 million pounds (about 30,000 bales) of short-staple cotton having a length of less than 1-1/8 inches and a quota of 45.7 million pounds (about 95,000 bales) of long staple cotton having a length of 1-1/8 or more inches.

Industrial fabrics. A broad term for fabrics used for nonapparel and nondecorative uses. These uses fall into several classes: (1) a broad group of fabrics employed in industrial processes such as filtering, polishing, and absorption; (2) fabrics combined with other materials to produce a different type of product such as tires, hose, and electrical machinery parts; and (3) fabrics incorporated directly in a finished product such as tarpaulins, tents, and awnings.

International Cotton Advisory Committee (ICAC). A worldwide association of governments which assembles, analyzes, and publishes data on world production, consumption, stocks, and prices. ICAC closely monitors developments in the world cotton market and promotes intergovernmental cooperation in developing and maintaining a sound world cotton economy. Headquartered in Washington, DC.

International Institute for Cotton (IIC). A nonprofit organization of cotton producing countries founded in 1966. Its purpose is to increase world consumption of cotton and cotton products through utilization research, market research, sales promotion, education, and public relations. Headquartered in Brussels, Belgium.

Inventory (CCC). The quantity of a commodity owned by CCC at any specified time. For example, about 123,000 bales of Upland cotton were in CCC inventory (owned by CCC) on July 31, 1985.

Knitting. A method of constructing fabric by interlocking a series of loops of one or more yarns. The two major classes of knitting are warp knitting and weft knitting. In warp knitting, yarns run lengthwise in the fabric; in weft knitting, the thread runs back and forth crosswise in a fabric. Warp knit fabrics are flatter, closer, and less elastic than the weft knit. Tricot and milanese are typical warp knit fabrics, while jersey is a typical weft knit.

Lint. Raw cotton that has been separated from the cottonseed by ginning. Lint is the primary product of the cotton plant, while cottonseed and linters are byproducts.

Linters. The fuzz or short fibers which remain attached to the seed after ginning. Linters are usually less than 1/8 inch in length and are removed from the seed by a delinting process.

Long staple cotton. Refers to cotton fibers whose length ranges from 1-1/8 inches to 1-3/8 inches. Fibers whose length is 1-3/8 inches or more are known as extra long staple (ELS).

Loom. A machine which weaves fabric by interlacing a series of lengthwise (vertical) parallel threads, called warp threads, with a series of crosswise (horizontal) parallel threads, called filling threads.

Manmade fibers. Industrially produced fibers, as contrasted with such natural fibers as cotton, wool, and silk. Examples are nylon, rayon, acetate, acrylics, polyester, and olefin.

Marketing year. The U.S. cotton marketing year begins August 1 each year and ends on July 31 of the following year.

Micronaire reading. The results of an airflow instrument used to measure cotton fiber fineness and maturity (see Cotton quality).

Middling. The designation of a specific grade of cotton (see Cotton quality). Grades are determined by the amount of leaf, color, and the ginning preparation of cotton, based on samples from each bale of cotton. Middling is a high-quality white cotton.

Mill (textile). A business concern or factory which manufactures textile products by spinning, weaving, or knitting.

Mill consumption. Quantity of a fiber processed in manufacturing establishments.

Moduled seed cotton. A mechanical module builder compresses cotton into large modules in the field after harvest so that cotton may be held temporarily on the farm or at the gin while awaiting ginning. About 40 percent of U.S. cotton is moduled. This practice is especially important in the Southwest and West.

Motes. Cotton waste material from the cotton ginning process, primarily resulting from the lint cleaning operation. Motes can be reclaimed and sold for use in padding and upholstery filling, nonwovens, and some open-end yarns.

Multifiber Arrangement (MFA). The MFA, negotiated under the auspices of the General Agreement on Tariffs and Trade (GATT), provides a set of complex rules which signatory nations agree to abide by when negotiating bilateral agreements to control trade in cotton, wool, and manmade fiber textiles and apparel. In 1985, the United States had bilateral textile agreements with 36 exporting countries, most of which were negotiated under the rules of the MFA.

Naps. Large tangled masses of fibers that often result from ginning wet cotton. Naps are not as detrimental to quality as neps.

National Cotton Council of America (NCC). The central organization representing all seven sectors, or interests, of the raw cotton industry of the United States: producers, ginners, warehouses, merchants, seed crushers, cooperatives, and manufacturers (spinners). NCC is a voluntary private industry association established in 1939. NCC programs include technical services, foreign operations, communication services, economic services, and Government liaison. Headquartered in Memphis, TN.

Natural fibers. Fibers of animal (such as wool, hair, or silk), vegetable (such as cotton, flax, or jute) or mineral origin (such as asbestos or glass).

Neps. Very small, snarled masses or clusters of fibers that look like dots or specks in the cotton lint and are difficult to remove. If not removed, they will appear as defects in the yarn and fabrics.

Noncellulosic fibers. Fibers made from petroleum-derived chemicals. The major types are polyester, nylon, acrylic, and polypropylene.

Nonrecourse loan. Delivery to the CCC of the pledged and eligible commodity, or warehouse receipts representing stocks acceptable as to quantity and quality, constitutes repayment of the price support loan in full, regardless of the current market value of the commodity.

Nonwoven fabrics. Material made primarily of randomly arranged textile fibers held together by an applied bonding agent or by fusion.

Offsetting compliance. When an offsetting compliance program is in effect, a producer participating in a diversion or acreage reduction program must not offset that reduction by overplanting the acreage base for that crop on another farm.

Oilseed crops. Major U.S. oilseed crops are soybeans, cottonseed, flaxseed, peanuts, sunflower seed, rapeseed, and sesame seed. Other oils include palm, olive, coconut, tung, and castor.

Open-end spinning. Processing fibers directly from a fiber supply, such as a roving sliver, to the finished yarn, in contrast to ring spinning. Three basic open-end methods are mechanical, electrostatic, and fluid or air. Advantages over ring-spun yarns include increased speed, less labor, and less floor space for equipment.

Operator (farm). The person who is in general control of the farming operation on the farm during the program year.

Parity price. The price which will give agricultural commodities the same relative purchasing power in terms of goods and services farmers buy that prevailed in a specified base period. This concept was first defined by the Agricultural Adjustment Act of 1933. The parity price formula is not a comprehensive measure of the economic well-being of farmers, nor does it measure cost of production, standards of living, or income parity. The parity price formula is based on price relationships, and reflects only one component of cost of production and income.

Pick. A filling yarn or thread that runs crosswise in woven goods.

Pile. The cut or uncut loops which make the surface a pile fabric. Some common pile fabrics include velvet, corduroy, terry toweling, furniture covering, and rugs and carpets.

Ply. The number of single yarns twisted together to make a composite yarn. When applied to cloth, it means the number of layers of fabric combined to give the composite fabric.

Point. A term used in quoting the price of raw cotton. One point is equal to 1/100 of a cent.

Price, raw cotton. There are several different cotton price series, each of which represents a different time and space dimension in the market. All price series, ranging from U.S. farm prices to international prices, are linked by common fundamental demand and supply factors.

Farm price. The season-average price received by farmers for cotton is a sales-weighted average of prices received by farmers during the marketing season at the point of first sale, usually on the farm or at a local delivery point. This USDA series is available for Upland cotton by months and by State and for ELS cotton by marketing year and by State and is reported in Agricultural Prices, published by USDA's National Agricultural Statistics Service. An important use of Upland cotton farm prices on a calendar year basis is to determine Government deficiency payments.

Futures price. The current price of cotton established at a futures exchange to be delivered at some future date. Futures contracts are primarily traded by merchants to hedge their price risks but are also used by growers, mills, and others to reduce risks of adverse price movements. The so-called No. 2 contract, covering SLM white 1-1/16-inch cotton, is traded daily on the New York Cotton Exchange. The Chicago Rice and Cotton Exchange's short staple cotton futures contract covers SLM Light Spotted 31/32-inch cotton.

International price. There is no statistically valid, single estimate of a world price. Two popular measures are reported by Liverpool Cotton Services, Ltd., publishers of Cotton Outlook. The Outlook "A" index is a simple arithmetic average of the five lowest priced growths of Middling 1-3/32-inch cotton delivered to northern Europe from various exporting countries. The "B" index is a simple average of the three lowest northern European prices of the six quoted for shorter staple coarse cotton varying in staple length from 1 inch to 1-3/32 inches. These prices are used to compare export competitiveness of American and foreign growths.

Mill price. The price for cotton delivered to mills in western North Carolina and South Carolina is commonly referred to as Group B mill price. These prices, including landing and brokerage costs, are quoted for cotton of given grades and staples from given regions. The SLM 1-1/16-inch price is often compared with polyester staple and rayon staple prices to indicate cotton's competitive position in the raw fiber market.

Spot price. A spot or cash market price represents the price for which cotton of various qualities was sold at warehouse locations in eight market areas designated by the Secretary of Agriculture. Spot market quotations are issued by committees made up of local members of a voluntary trade organization known as the Cotton Exchange. These exchanges provide a means of establishing premiums and discounts for the Government's cotton loans to producers and for settling futures contracts. The spot market price also represents the market value of cotton in the early stages of the wholesale marketing chain.

Price support. Government price support programs for cotton and other farm commodities are administered by USDA's Agricultural Stabilization and Conservation Service. Various methods of supporting producers' price have been used over the years. Support has commonly been achieved through nonrecourse loans, purchases, and payments at announced levels. Recent legislation is designed to make export commodities more competitive in world markets through market price support at or near world price levels. At the same time, producers' incomes are enhanced through deficiency payments. Export competitiveness is further enhanced by issuing marketing certificates to first handlers if world prices fall below producers' loan repayment levels.

Producer. A person who, as owner, landlord, tenant, or sharecropper, is entitled to a share of the crops available for marketing from the farm or a share of the proceeds.

Program (agricultural). Government activities aimed at accomplishing a certain result. Such activities include agricultural price support loans, purchases and payments, commodity storage, transportation, exports, and acreage reduction.

Program costs. No single definition is applicable to all uses. Program costs may be gross or net expenditures of the CCC on a commodity during a fiscal year or other period. Program costs may be the realized loss on disposition of a commodity, plus other related net costs during a fiscal year or other period. Program costs may be the net costs attributed to a particular year's crop of a commodity during the marketing year for that commodity.

Public Law 480 (P.L. 480). The principal legislative authority for channeling U.S. food and fiber to needy countries. First enacted in 1954, P.L. 480 was extended by the Food for Peace Act of 1966 and subsequent legislation.

Quality. See Cotton quality.

Raw fibers. Textile fibers in their natural state before any manufacturing activity has taken place; for example, cotton as it comes from the bale.

Referendum. The referral of a question to voters to be resolved by balloting; for example, marketing quotas, acreage reduction, or marketing agreements.

Residual supplier. A country which furnishes supplies to another country only after the latter has obtained all it can from other preferred sources.

Roving. An intermediate stage of yarn making between sliver and yarn; the last operation before spinning into yarn.

Running bale. Any bale of varying lint weight as it comes from the gin.

Sea Island. See Cotton.

Seed cotton. The raw product which has been harvested but not ginned, containing the lint, seed, and foreign matter.

Skip-row planting. The practice of planting one or more rows in uniform space, then skipping one or more rows, to conserve moisture in dryland areas or to increase yields on land actually planted, or both.

Sliver. A strand or rope of fibers without twist. In yarn manufacture, a sliver is formed by the carding machine and is of greater diameter than roving.

Soft fibers. Flexible fibers of soft texture obtained from the inner bark of dicotyledonous plants. Soft fibers are fine enough to be made into fabrics and cordage. Examples are flax, hemp, jute, kenaf, and ramie. See Hard fibers.

Spinning. The process of drawing fibers that may be in roving or rope form, twisting the appropriate number of turns per inch, and winding the yarn on a bobbin or other suitable holder.

Spinning quality. The ease with which fibers lend themselves to yarn-manufacturing processes.

Spot price. See Price, raw cotton.

Staple fibers. (1) Natural fibers whose length usually ranges from about 1 inch to 1-1/2 inches, such as cotton. (2) Manmade fibers which have been cut to the length of the various natural fibers to facilitate blending and further processing with other fibers.

Strict Low Middling 1-1/16-inch cotton. The grade and staple length used as the basis on which the CCC, USDA, establishes its loan rates. Higher qualities receive loan premiums and generally higher market prices, while lower qualities receive lower loan rates and lower prices (see Cotton quality).

Supima. Trademark of an ELS cotton, commonly referred to as American Pima cotton, produced in Arizona, New Mexico, and West Texas. Supima Association of America is a producer association headquartered in Phoenix, AZ.

Synthetic fibers. Fibers made from petroleum-derived chemicals that were never fibrous in form. They are categorized as noncellulosic fibers.

Tare. The weight of the ties (or bands) and wrapping materials that contain the bale of cotton. The quoted net weight of a bale excludes the tare, whereas the gross weight includes tare.

Tex. A system of yarn numbering that measures the weight in grams of 1,000 meters of yarn. A 30-tex yarn weighs 30 grams per 1,000 meters.

Texture. The number of warp threads (ends) and filling yarn (picks) per square inch in a woven fabric. For example, 88x72 means there are 88 ends and 72 picks per square inch in the fabric.

Textile. Any product made from fibers, including yarns, fabrics, and end-use products such as apparel, home furnishings, and industrial applications.

Twist. The number of turns per unit of length of the fiber, strand, roving, or yarn. In the United States, twist is measured in terms of the number of turns per inch.

Universal density bale. A bale of cotton compressed to a density of 28 pounds per cubic foot.

Upland cotton. See Cotton.

Warp. The yarns that run lengthwise in a woven or warp-knit fabric.

Wash and wear. A term applied to any garment which can be washed, dried, and then worn again with little or no ironing. Also called "durable press" or "permanent press."

Weft. The filling yarns that run crosswise in woven fabric or weft-knit fabric.

Weight of fabric. Three methods are used to measure fabric weight: (1) linear yards per pound, (2) ounces per linear yard, and (3) ounces per square yard.

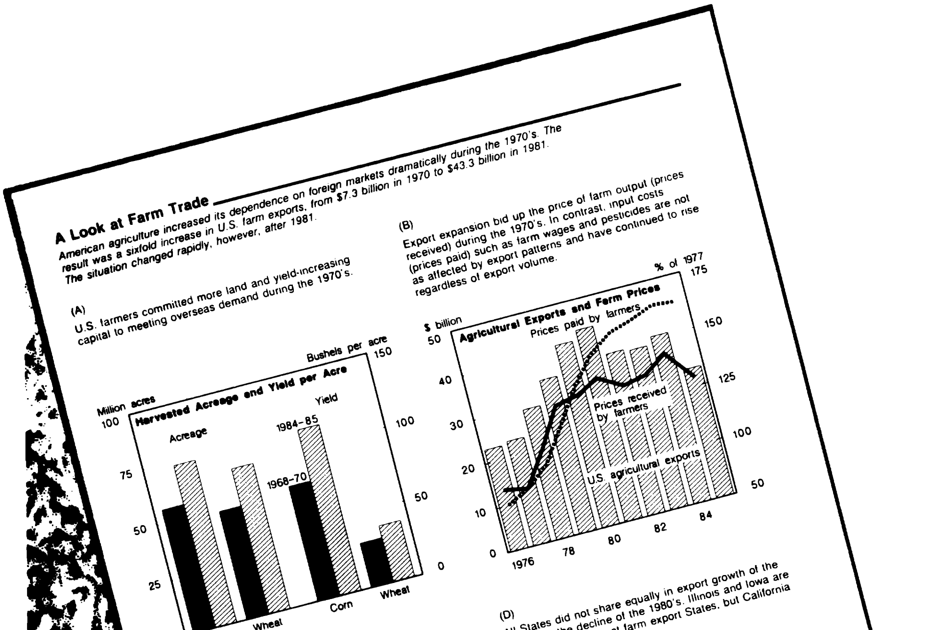
World price. Often refers to the c.i.f. price of an imported agricultural commodity at the principal port of importation of a major importing country or area (see Prices, raw cotton).

Woven fabric. Fabric made by interlacing two sets of yarn at right angles. The warp yarns run lengthwise in the fabric; the filling (weft) yarns are passed over and under the warp yarns.

Yarn. A continuous strand of twisted (spun) fibers of any kind and of varying staple length, usually used in the weaving or knitting of fabric.

Yarn size. Yarns, or threads, are numbered according to weight. The higher numbers denote fiber fineness. A "1s" cotton yarn has 840 yards in a pound; a "30s" cotton yarn has 25,200 yards in a pound. A "30/2" is a two-ply yarn containing two strands of 30s. Also see Cotton count.

*U.S. Government Printing Office : 1987 - 180-917/60296



1986
Agricultural Chartbook

AH-663. November 1986. 124 pp. Order SN. 001-019-00488-6. $5.50

What's happening with farm trade? How did farm income fare in 1985? Those and other subjects are illustrated in the 1986 Agricultural Chartbook. The 310 charts illustrate data and trends for agricultural subjects ranging from farm income to consumer costs, and from commodities to agricultural trade. Charts showing food programs, cost of production figures, farmland numbers, and population trends round out the agricultural picture. Call GPO at (202) 783-3238 for ordering information.